COMMERCIAL FISHERIES REVIEW

May 1964 Washington, D. C. Vol. 26, No. 5

SECOND WORLD FISHING GEAR CONGRESS

By Edward A. Schaefers* and Dayton L. Alverson**

On May 25, 1963, the Second World Fishing Gear Congress, arranged by the Food and Agriculture Organization of the United Nations, convened in London, England. Six years had ...sed since the First World Fishing Gear Congress, also arranged by FAO, convened in ...burg, Germany. Some 600 delegates from 50 countries registered for the Second Con...s at which 87 technical papers were presented and discussed during the five days of tech... sessions (May 27-31).

To facilitate presentation and discussion, papers were divided, by natural classifications, i... three main subjects: Materials, Gear and Fishing, and Gear Research. Each of these ...ors subjects included a wide variety of topics. Rapporteurs from various countries were ...en to summarize one or more topics under each major subject.

MATERIALS

The discussion on materials centered around a review of the most widely used synthetic ...rs which play such an important role in today's fisheries. Three topics, knotless netting, ...se of monofilament nets, and new net materials, received the greatest emphasis. In con... to the 1957 Gear Congress, when a host of new synthetic fibers were being incorporated ...fisheries, only one new synthetic fiber, polypropylene, was discussed in detail at the 1963 ...gress. Experiments with this material have resulted in favorable catches during fishing ... in Japan, England, Germany, and the United States. These results suggest increased use ...is fiber in fisheries. The introduction into fisheries of only one new synthetic net mate... in the past several years is not surprising considering the wide group of synthetic fibers ...h were introduced and adopted prior to 1960. When those materials were first tried by ...ous fisheries their efficiency was judged by comparing their physical and chemical prop...s with those of natural fibers. Synthetics having desirable characters were soon adopt... to world fisheries. Accordingly, new net materials must now compete with high-quality, ...-proven synthetic twines, and must have characteristics which make them more suitable ...se in fisheries than existing synthetic twines.

The most striking change in the discussion on synthetic fiber materials between the 1957 ... 1963 Gear Congresses was the complete acceptance at the latter Congress of synthetic ...rs as the dominant material used for net construction. During the 1957 Congress synthet...bers for fishing nets were relatively new. Considerable debate occurred as to the desir...ity of synthetic materials for use in various fisheries and as to the comparative merits of ...ral and synthetic fibers.

In Japan, where synthetics were introduced into the fishing industry in 1949, the use of ...e fibers for fabrication into fishing nets has increased at a tremendous rate and by 1959 ...tal of 21.2 million pounds were reported as having been used. Two years later, in 1961, ... of synthetics for nets had risen to 30.7 million pounds (table). Correspondingly, there ...been a decrease in the use of natural fibers for netting in Japan--from 28 million pounds

*...hief, Branch of Exploratory Fishing, U. S. Bureau of Commercial Fisheries, Washington, D. C.
**...se Director, Exploratory Fishing and Gear Research Base, U. S. Bureau of Commercial Fisheries, Seattle, Wash.

U. S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Sep. No. 703

Japanese Production of Synthetic Fibers for Fishing Nets, 1955, 1957, 1959, and 1961

Product	1961	1959	1957	1955
	. . . . (1,000 Lbs.)			
Synthetic Fibers:				
Nylon	12,749	8,314	6,123	3,535
Vinylon	12,679	8,923	7,410	3,890
Polyvinylidene chloride	1,393	1,467	1,388	1,148
Polyvinyl chloride	574	1,056	931	-
Polyester	238	-	-	-
Polyethylene	1,716	-	-	-
Twisted blended yarn of filament	1,333	1,452	1,089	42
Total synthetic fibers	30,682	21,212	16,941	8,615
Natural Fibers:	4,413	10,668	13,869	24,781

Source: "Synthetic Fibre Fishing Nets and Ropes Made in Japan," by Japan Chemical Fibres Association, Tokyo, Japan (see Appendix).

in 1949 to only 4.4 million pounds in 1961. With regard to Japanese synthetic fiber fishing nets for export, the total soared from 383,000 pounds in 1955 to 10.6 million pounds in 1961 and found markets in more than 100 nations. The delegates were quite surprised to learn that while conversion to synthetics was 85 percent for netting, about 90 percent of the ropes used are still of natural fibers. Although the trend in Japan is perhaps somewhat more dramatic than that which has occurred in other fishing nations, the use of synthetics as compar to natural fibers for nets has followed the same general trend throughout the world.

Knotted netting is still the main material used in net construction by the fishing industry throughout the world. Knotless netting, however, is becoming increasingly important. Knotless netting is currently produced in two types; the Japanese twisted type and the Raschel knitted type. In Norway, West Germany, Belgium, Peru, and the United States, the major increase in use of knotless netting has been in the Raschel type. The manufacture of this type is based on the Raschel-technique, well known in curtain material manufacture for at least 100 years. The use of Raschel-type netting in Norwegian fisheries increased from 17 tons 1960 to approximately 200 tons in 1962.

No detailed discussion occurred concerning the differences in catchability between knotless and knotted webbing. The major advantage of knotless webbing was reported to be its lower cost. For example, in Norway purse seines made from small-mesh knotless netting were reported to be from 25 to 30 percent cheaper than those made from knotted netting. With increasing mesh size, however, a point is reached when knotted netting can currently be produced more economically. It was also brought out that in Peru, 75 of the 1,200 purse seines now in operation are made of knotless netting, and that a new factory was recently established there which should produce 400 tons of Raschel knotless netting each year.

Monofilament netting was also predicted to play an increasingly important role in world fisheries, particularly in gill-net fishing for species currently underutilized. In Viet Nam, monofilament netting is already the most popular material used for gill nets, outnumbering multifilament gill nets 8,000 to 160.

It was emphasized throughout the discussions on synthetic materials that it is most important not to generalize concerning the effectiveness of specific types of synthetics, particlarly when the generalizations were derived from experiments in only one fishery and in one geographic area. Success of synthetics in one area or fishery does not insure its success in similar fisheries in other areas.

GEAR AND FISHING

Topics under the subject Gear and Fishing ranged from stern trawling to fish detection. A considerable portion of the time available for discussing fishing gear and fishing methods was devoted to stern, midwater, and bottom trawling. The predilection for trawling obvious resulted from the large number of participants at the meeting from nations where trawling represents a major harvesting technique. For example, in Great Britain more than 70 percent of the fish landed are taken with trawls.

A considerable portion of the time spent in discussing stern trawling was devoted to smaller vessels ranging in length from 70 to 100 feet. Particular attention was drawn to the 83-foot United States combination stern trawler-purse seiner Narragansett and to the 99-foot English stern trawler Ross Daring. The high degree of automation and extensive use of centralized controls by both those vessels allows considerable reduction in manpower while improving handling procedures. The Narragansett, for example, is designed to operate with only three fishermen, while the Ross Daring is capable of operating with five.

Although some disagreement occurred concerning the desirability of increased mechanization and centralized controls aboard fishing vessels, the opponents of mechanization failed to convince the majority. But it was obvious that the mechanization trend will continue (fig. 1). In fact, it was the opinion of many of the delegates that the main key to the survival of the fishing industry as a business proposition is a continual increase in automation and mechanization aboard fishing craft. Such increases in automation must lead to greater productivity for fishermen.

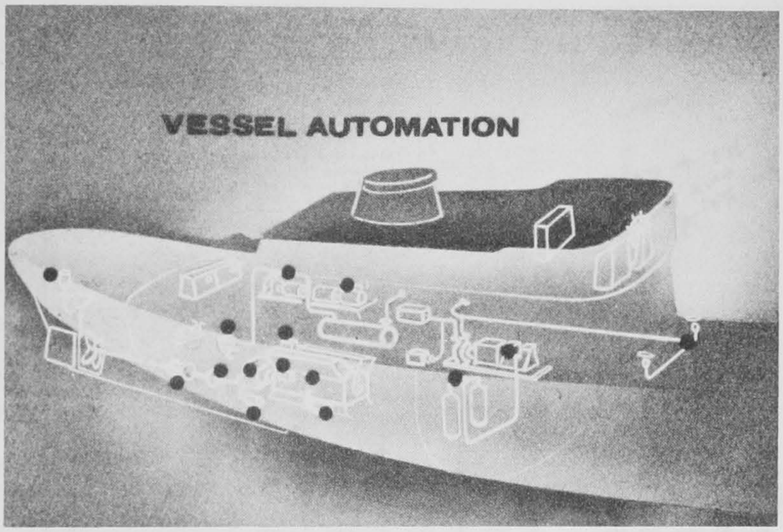

Fig. 1 - Vessel automation--circles indicate operations that can be automated or remotely controlled aboard fishing vessels.

The advancements indicated in bottom trawling since the 1957 Fishing Gear Congress were disappointing and only one real breakthrough occurred which appears to offer any real possibilities of improving efficiency or effectiveness of this method of fishing. This concerns developments in the use or application of electricity to bottom trawls for capturing bottomfish and shrimp. Experiments with electrical trawls were regarded as offering significant possibilities of improving their catching ability. The use of electricity to bring about galvanonarcosis of fish in front of the trawls was reported to increase the catching efficiency, depending on species, from about 100 to 500 percent.

A paper describing possibilities of improving the capture of shrimp which burrow during daylight hours by applying an electrical shocking system to the trawl, was one of the more impressive contributions involving trawling. The results of the electrical shocking caused shrimp to rise from their burrows to where they were susceptible to being captured by the trawl.

Although considerable attention was given to midwater trawling, advancements in that method of fishing since 1957 had not occurred at a pace which investigators had desired. Delegates, who anticipated hearing of Japanese midwater trawling experiments in the eastern China Sea, were disappointed as that paper was not assembled in final form before the meeting adjourned. It was reported, however, that midwater trawls had been used to capture shrimp in the eastern China Sea with considerable success. It was stated that some 200 Japanese vessels are now engaged in midwater trawling for shrimp in that area. Midwater trawling is carried out as a single boat operation with vessels of approximately 370 tons using a trawl with a 160-foot headline; pair trawling is conducted from two smaller bull trawlers working side-by-side using a net with a 200-foot headline. The success of the Japanese midwater shrimp trawling appears to be keyed to accurate vertical control of the net which is achieved through use of an acoustical device which records in the wheelhouse the depth that the net is fishing. Considerable discussion occurred on the effectiveness of one-boat versus two-boat midwater trawling. It would appear that in spite of several successful one-boat operations that, in general, two-boat midwater trawling had been more productive from a commercial standpoint.

A notable change was apparent in the concept of the use of midwater trawls. Some of the more vigorous proponents of midwater trawling, who previously viewed that gear as a panacea for the problems confronting bottom trawling, now look on midwater trawls as tools to be used interchangeably with bottom gear. Thus, when conditions appear appropriate for use of midwater trawls, that is, when fish appear to be congregated in dense schools above the bottom, this type of gear would be used. In other circumstances, however, conventional bottom gear would be employed.

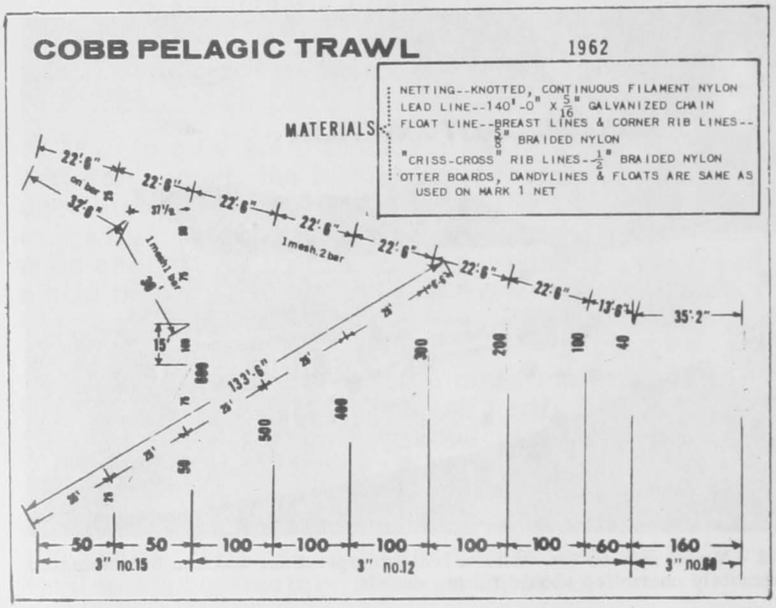

Fig. 2 - Extremely large midwater trawl being developed in the United States and designed to be towed at slow speeds. Most previous efforts have been towards development of small midwater trawls to be towed at high speeds.

An extremely large midwater trawl developed in the United States was discussed in some detail (fig. 2). This trawl was designed primarily to evaluate whether or not relatively fast-swimming pelagic species could be captured in midwater trawls. The gear achieved some success in that bonita, barracuda, mackerels, and other relatively rapid-swimming species were taken. The gear is at present, however, considered successful only as a biological sampling tool although alterations and continued experiments with the gear are designed toward developing a successful commercial net.

It was apparent that most people were impressed with the rather significant improvements in fish-detecting devices in recent years, particularly for distinguishing schooling species just off the bottom and for horizontal echo-ranging. The efficient use of modern echo-sounding equipment for fish detection and fishing tactics has become an important part of many fisheries. Although there have been considerable improvements in the sensitivity and resolution of acoustical devices, the improvements have been paralleled by increased difficulty in interpretation and operation, these requiring specialized training and greater skill in the fishermen who use them. In the Norwegian fisheries the need for training in sonar operation has become an urgent matter, and several years ago instruction courses were organized. Those courses, which originally required eight days of training, are expected to be lengthened. The present course given in Norway has the objective of training operators in proper use of the equipment and to classify and identify echo traces.

In addition to fish detection through echo-sounding, airplane spotting was discussed at considerable length, although not a single paper was prepared on the subject. This technique is used rather widely on both coasts of North America, and on the west coast of South America. In Chilean fisheries some operators reported that one spotter plane could successfully be employed to assist ten catcher vessels.

Fleet operations involving motherships, although certainly not new, were the subject of considerable debate. Such operations are now carried out in practically all major oceans. Although fleet operations of that type date back some 300 years, there has been a rapid expansion and buildup of fleet operations throughout the world in recent years. Such operations are now directed toward capture of a great variety of species including bottomfish, king crab, tuna, and sardine-like fishes. Although a distinct trend has occurred among European nations toward operation of independent freezer trawlers and factory trawlers, this method has not proved successful in all instances. It was felt that where it is necessary to carry out fishing operations at considerable distances from home ports (greater than 4,000 miles), mothership operations are more successful.

There was little if any evidence of a major breakthrough in changes or mechanization in the handling of longline gear. An interesting paper on mechanization of dropline fishing at depths of 500 fathoms in the South Pacific, however, received favorable comment (fig. 3). An excellent example of mechanization of a fishery, however, was provided in a paper describing Alaskan king crab operations. This fishery produced approximately 50 million pounds of king crab from a fleet of about 200 vessels in 1962. The success of the fishery can be attributed to the efficiency of the modern king crab pot and to methods used in handling and hauling pots with gypsy winches or V-grooved hydraulic pot haulers. Alaska king crab pots measuring 7 feet x 7 feet x 2½ feet and weighing approximately 200 pounds each are commonly used. Some of the pots have caught over 200 crabs thus giving the pot and its contents a total weight of approximately 2,200 pounds. On an average, however, 50 crabs per pot is considered good fishing.

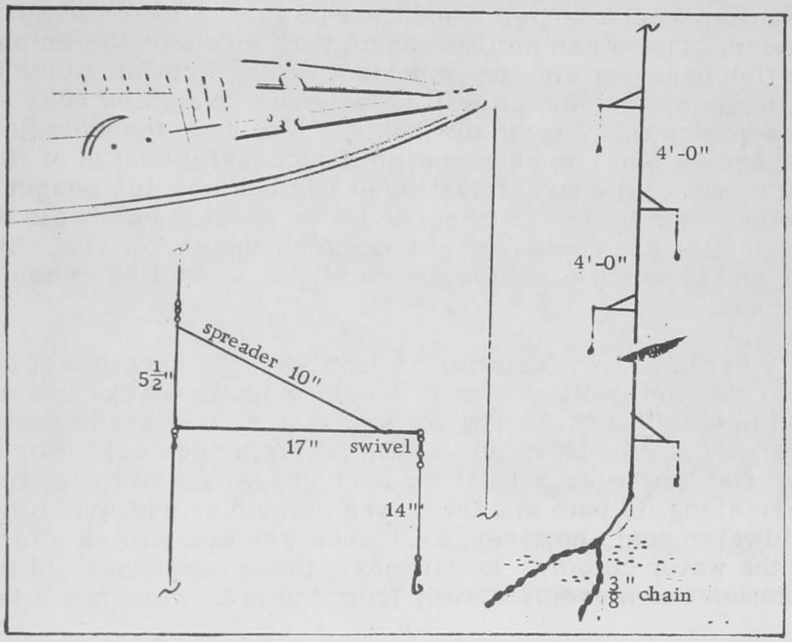

Fig. 3 - Mechanized dropline gear--steel wire leads over bow of vessel to gurdy drum powered by small gasoline engine.

Although only one document was presented at the conference describing purse-seining techniques, considerable discussion was initiated from the floor concerning purse-seine activities, with particular attention devoted to the South American anchovetta fishery and the United States tuna operation. It was noted that in the case of the United States tuna fishery an almost complete conversion from the previous pole-and-line method occurred. In other fisheries minor modifications and adjustments in purse-seine techniques have resulted in more effective operations. In general, the increased efficiency in seining operations has been attributed to the adoption of power-hauling techniques (generally the power block), synthetic twines, and more effective methods of fish detection. In purse-seining operations, fish detection includes the use of aircraft and horizontal-scanning techniques. Delegates pointed out the necessity of adapting purse-seine operations to local conditions and to varying fishing tactics depending on species being sought.

GEAR RESEARCH

The final topics of the gear congress were under the subject of Gear Research. Topics discussed included instrumentation, fish behavior, application of telemetry and computers to fisheries problems, and finally, a look into the future of fishing.

The session considering instrumentation and dynamics of fishing gear was involved with methods of measuring the various forces acting upon towed fishing gear, primarily trawls. Various studies conducted in Japan, Norway, and England on the resistance of netting, trawl doors, warps, and other components of the gear related numerous facts (some conflicting) concerning the most effective design for trawls. Some of the varying opinions concerning efficient trawl design presumably result from differential behavior patterns of species sought. The progress in instrumentation, however, appears to be on the verge of contributing several devices which may be used by commercial fishermen in the near future. Possible devices include on-bottom indicators, cod-end load indicators to determine the quantity of fish captured and automatic positioning and control devices for midwater trawls.

Improvement in the array of fishing devices currently available to fishermen in the future is perhaps largely dependent on the accrual and advancement of the knowledge of fish behavior. There can be little doubt that considerable emphasis was placed during the Congress on fish behavior and the importance of determining diurnal, seasonal, and geographic behavior patterns of species, as well as behavior to fishing gear and physical or chemical stimuli. It was quite evident from discussions that gear technologists, biologists, net manufacturers, and fishermen must be cognizant that successful design of fishing gear will require more data on the behavioral characteristics of various species sought. This field has been neglected to some extent by gear technologists as greater emphasis was placed on physical engineering properties of gear and the behavior of the gear itself. To be effective, however, the engineering and physical characteristics of gears must be considered along with behavioral aspects of fishes.

Preliminary experiments involving the reaction of commercial species of fishes such as herring, cod, whiting, and haddock, indicate that of the various stimuli produced by stationary and moving gears, visual responses are the most important and therefore determine to a large degree the effectiveness of fish-capturing devices. For example, in daylight it was observed that fish in the vicinity of the seabed respond to towed trawls by swimming away from the gear along its path and there was no evidence of avoiding the gear by swimming upwards. In midwater gear, however, avoidance was sometimes effected by sounding or moving downward in the water column. In darkness, those responses did not appear to take place, and the orientation and movement away from the gear were much less pronounced.

The various papers presented and the resulting discussions indicated that considerable knowledge is being compiled and assembled from fishermen and scientific investigators on the general behavior patterns of marine commercial species. There are, however, many unknowns concerning detailed behavior responses of fish to natural environmental and artificial influences. It is obvious that greater emphasis is now being placed by marine scientists on conducting experiments on the behavioral aspects of fish in their natural environment, rather than in tanks ashore, which has been the case in the past.

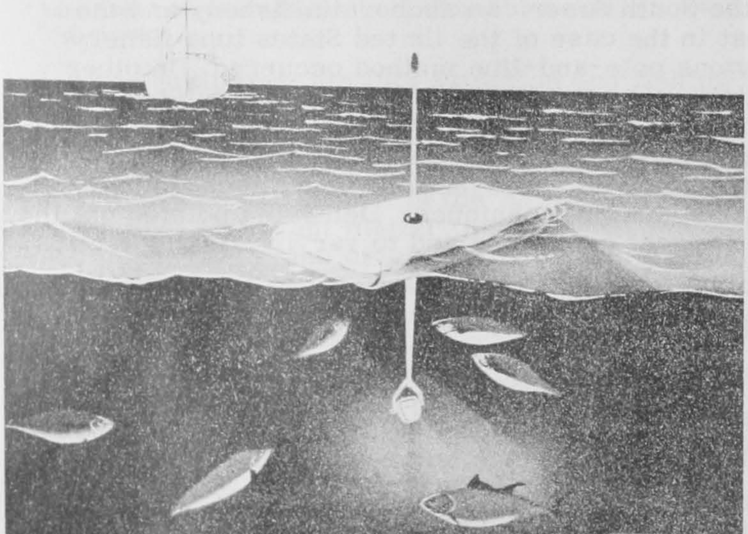

Fig. 4 - "Artificial log" would be designed to attract and detect schools of pelagic fish and relay to a catcher vessel information on concentrations of fish in vicinity of the "log."

Future harvesting methods and the possible applications of high-speed computers and associated elements of automatic data processing to the fishing industry were the final topics of the Congress. It was reported that at least one United States fishing company is currently using computer techniques and that high-speed digital computers have been utilized by some shipbuilders to resolve form lines.

Future concepts of fishing were discussed with emphasis being placed on the need to adapt engineering principles employed in industry, military, and space fields. Improvements in the next several decades visualized possible systems that might be employed to increase harvest of living resources of the seas. Those discussed included retrievable buoys with built-in detection systems which could automatically signal a catcher vessel of the presence of fish. Artificial logs were suggested for attracting fish. Those would also have built-in detection systems for automatically signaling a catcher vessel when commercial concentrations of fish were present (fig. 4). A network of oceanographic buoys was envisaged which would detect and transmit their data through satellite telemetry to a shore site "hydro-central." The data would be collated, analyzed, and transmitted back via facsimile methods to fishing vessels and to various fishing centers throughout the world. Also discussed was the possibility of application to fishing vessels and fishing gear of lightweight materials developed for space vehicles.

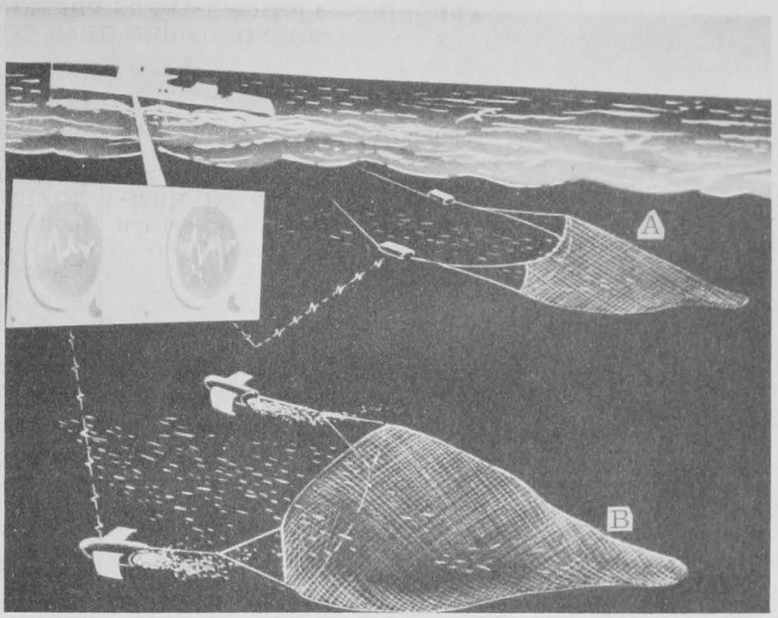

Fig. 5 - Possible futuristic midwater trawling:
A--Midwater trawl with powered spreading devices controlled from bridge through electrical conductors.
B--Midwater trawling with self-contained power units remotely controlled from vessel.

CONCLUSIONS

In reviewing the various papers presented and considering the discussions which were initiated from the floor by the delegates, it was obvious that some basic changes had occurred in concepts of fishing since the first Congress was held in Hamburg in 1957. At the 1957 Congress stern trawlers were just entering fisheries and they were the subject of considerable debate. Their success was doubted in many instances and many looked upon them as exotic experimentation. At the 1963 Congress, however, they were an accepted and important constituent of the modern trawling fleets and there could be little doubt of their continued and expanded use. Synthetics, which were also a somewhat new commodity in fisheries at the 1957 Congress, have since been universally accepted.

The 1963 Congress perhaps did not provide any major breakthroughs of proven commercial feasibility in new systems of harvesting fish and other living resources, but there was strong evidence of the realization for the necessity of applying modern engineering concepts to fisheries, to automation of fishing vessels, and the need to strike out boldly into new frontiers with radically new fish-capturing devices. To help resolve those problems, greater emphasis is being directed toward understanding fish and their reaction to natural and artificial stimuli. It would seem that by the time of the next fishing gear congress, research in those fields will have been instrumental in developing entirely new tactics for application to fisheries throughout the world.

\- - - - - - -

The "Appendix - List of Papers Presented at the Second World Fishing Gear Congress," appears on pages 8-11.

\- - - - - - -

APPENDIX - LIST OF PAPERS PRESENTED AT THE SECOND WORLD FISHING GEAR CONGRESS

Subject: MATERIALS

Topic: Netting Twines - Standardization of Terminology and Numbering Systems

STANDARDIZATION OF TERMINOLOGY AND NUMBERING SYSTEMS FOR NETTING TWINES, by Gerhard Klust, Institut für Netz- und Materialforschung, Hamburg, Federal Republic of Germany.

Topic: Standardization of Testing Methods

TEST METHODS FOR FISHING GEAR MATERIALS (TWINES AND NETTING), Edited by A. von Brandt, Institut fur Netz- und Materialforschung, Hamburg, Federal Republic of Germany. Revised by P.J.G. Carrothers, Fisheries Research Board of Canada, St. Andrews, New Brunswick, Canada.

Topic: New Net Materials

POLYPROPYLENE TWINES IN JAPAN, by Katsuji Honda, Professor Tokyo University of Fisheries, Tokyo, Japan, and Shigeru Osada, The Nippon Gyomo Sengu Kaisha Ltd., Tokyo, Japan.

SYNTHETIC FIBRE FISHING NETS AND ROPES MADE IN JAPAN, by Japan Chemical Fibres Association, Tokyo, Japan.

THE USE OF "ULSTRON" POLYPROPYLENE IN THE FISHING INDUSTRY, by C.L.B. Carter and K. West, Fibres Division, Imperial Chemical Industries Ltd., Harrogate, Yorkshire, England.

PRODUCTION AND CHARACTERISTICS OF SYNTHETIC NETS AND ROPES IN JAPAN, by Yoshinori Shimozaki, Tokai Regional Fisheries, Research Laboratory, Tokyo, Japan.

ETUDES SUR LE FREINAGE ET L'USURE DES FILS DE PECHE, by Maurice Bombeke, Establissements Cousin Frères, Wervicq-sud, France.

NETTING TWINES MADE OF POLYPROPYLENE AND POLYAMIDE, A COMPARISON OF THEIR PROPERTIES, by Gerhard Klust, Institut für Netz- und Materialforschung, Hamburg-Altona 1, Federal Republic of Germany.

NEW SYNTHETIC MATERIALS FOR HERRING DRIFTNETS USED IN THE NORTH SEA, by Janusz Zaucha, Sea Fisheries Institute, Gdynia, Poland.

Topic: Lines and Ropes

ROPES OF POLYETHYLENE MONOFILAMENTS, by C. C. Kloppenburg, Kunstzijdespinnerij "Nyma" N.V., Nijmegen, Netherlands, and J. Reuter, Nederlandsche Visserij-Proefstation en Laboratorium voor Materialen-Onderzoek, Utrecht, Netherlands.

Topic: Knotless Nets

KNOTLESS NETTING IN THE NORWEGIAN FISHERIES, by Norvald Mugaas, Statens Fiskeredskapsimport, Bergen, Norway.

TESTS ON KNOTLESS RASCHEL NETTING, by A. von Brandt, Institut für Netz- und Materialforschung, Hamburg, Federal Republic of Germany.

KNOTLESS FISHING NETS PRODUCED ON RAS EQUIPMENT IN ITALY, by Mario Damiani, Socie Rhodiatoce S.p.A., Milan, Italy.

RESISTANCE A LA RUPTURE DE FILETS SAN NOEUDS, by Francesco Pianaroli, Retificio Carlo inotti, Milan, Italy.

Topic: Monofilament Nets

MONOFILAMENTS IN FISHING, by W. Henstea British Celanese Ltd., Coventry, England, and D.F Ede, British Resin Products Ltd., Piccadilly, Lon England.

THE USE OF NYLON MONOFILAMENT IN THE VIET-NAM FISHERIES, by Tran-Van-Tri and Ha-Chu, Fisheries Directorate, Saigon, Viet-Nam.

MONOFILAMENT GILLNETS IN FRESHWATER ING--EXPERIMENTAL AND PRACTICAL RESULTS R. Steinberg, Institut für Netz- und Materialforsch Hamburg-Altona 1, Federal Republic of Germany.

Subject: GEAR AND FISHING

Topic: Stern Trawling

THE STERN TRAWLER - A DECADE'S DEVEL MENT IN TRAWL HANDLING, by Conrad Birkhoff, Fischereitechnische Konstruktionen, Hamburg 13, eral Republic of Germany.

SOME SMALL STERN TRAWLERS, by E.C.B. C lett, Burness, Corlett & Partners Ltd., Basingstok England.

ROSS DARING - EXPERIMENT, by Dennis Robe Ross Trawlers Ltd., Grimsby, England.

Topic: Bottom Trawling with High Opening Nets o and Wide Opening Nets

DEVELOPMENT OF AN IMPROVED OTTER T GEAR, by Chikamasa Hamuro, Fishing Boat Labo Fisheries Agency, Ministry of Agriculture and Fo ry, Tokyo, Japan.

SUGGESTIONS FOR IMPROVED HEAVY TRAW GEAR, by Eldon Nichols, American Telephone and graph Company, 32 Avenue of the Americas, New New York, U.S.A.

FLEET TRAWLING OPERATIONS, by Hiroshi inaga, 4, 1-Chome, Marunouchi, Chiyoda-Ku, Tok Japan.

THE DEVELOPMENT OF ELECTRICAL SHRIM TRAWLING GEAR, by Fredrick Wathne, U. S. Bur of Commercial Fisheries, Gear Research Station, ma City, Florida, U.S.A.

JAPANESE FISH NETTING OF SYNTHETIC FIB by Iwao Tani, Japan Synthetic Fibre Net and Rope ciation, Echizenbori, Chuo-ku, Tokyo, Japan.

TOWING POWER, TOWING SPEED AND SIZE O BULL TRAWL, by Chikamasa Hamuro, Fishing Bo Laboratory, Fisheries Agency, Ministry of Agricu and Forestry, Tokyo, Japan.

BLE-RIG SHRIMP BEAM TRAWLING, by J. Ve...st, Commissie T.W.O.Z., and A. Maton, Rijk- sta... voor Boerderijbouwkunde; both of the University of ...culture, Ostend, Belgium.

...E COMPARATIVE FISHING EXPERIMENTS IN TR... DESIGN, by W. Dickson, Department of Agri- cul... and Fisheries for Scotland, Marine Laboratory, To... Aberdeen, Scotland.

...E OF THE GENERAL ENGINEERING PRIN- CI... OF TRAWL GEAR DESIGN, by P. R. Crew, We... Aircraft Ltd., Saunders-Roe Division, East Co... Isle of Wight, England.

...ELOPMENT OF SOVIET TRAWLING TECH- NI... by A. I. Treschev, Institute of Marine Fisher- ies... Oceanography (VNIRO), Moscow, U.S.S.R.

To... Midwater Trawling

...ELOPMENT OF THE COBB PELAGIC TRAWL-- A... RESS REPORT, by Richard L. McNeely, Explor- at... ishing and Gear Research Base, Bureau of Com- m... Fisheries, Seattle, Washington, U.S.A.

...CTION OF HERRING TO FISHING GEAR STUD- IE... MEANS OF ECHO SOUNDING, by H. Mohr, In... für Netz- und Materialforschung, Hamburg, Fe... Republic of Germany.

...ERWATER TELEMETERS FOR MIDWATER T...S AND PURSE SEINES, by Chikamasa Hamuro an... ji Ishii, Fishing Boat Laboratory, Fisheries Ag... Ministry of Agriculture and Forestry, Tokyo, Ja...

...-BOAT MIDWATER TRAWLING FOR HERRING W... IGGER BOATS, by Rolf Steinberg, Institut für N... nd Materialforschung, Hamburg, Federal Re- pu... of Germany.

...ERSAL ONE-BOAT MIDWATER AND BOTTOM T..., by S. Okonski, Sea Fisheries Institute, Gdynia, P...

...-BOAT MIDWATER TRAWLING IN GERMANY, by ... harfe, Institut fur Netz- und Materialforschung, H...g, Federal Republic of Germany.

...E NOTES ON THE IMPORTANCE OF BIOLOG- I... ACTORS IN FISHING OPERATIONS, by B. B. P... and J.H.S. Blaxter, Marine Laboratory, Aber- d... cotland.

T... Gill-netting

...ANESE SALMON MOTHERSHIP FISHERY, by M... ke Neo, Nichiro Gyogyo Kaisha Ltd., Marunou- c...g., Tokyo, Japan.

...FTNET HAULERS FOR SALMON FISHING, by C... Miyazaki, Tokai Regional Fisheries Research L...tory, Tokyo, Japan.

...CHANIZATION OF DRIFTNET FISHING OPERA- T... by P. A. Kuraptsev, Institute of Marine Fisher- i... Oceanography (VNIRO), Moscow, U.S.S.R.

T... Long-lining

...IO-SOUNDER MEASUREMENT OF TUNA LONG- L... DEPTH, by Kyotaro Kawaguchi, Kanagawa Pre- fectural Fisheries Experimental Station, Misaki, Miura City, Japan; Masakatsu Hirana, Sanken Electronics Co., Numazu City, Japan; and Minoru Nishimura, Fishing Boat Laboratory, Fisheries Agency, Ministry of Agri- culture and Forestry, Tokyo, Japan.

MOTHERSHIP BOTTOM LONGLINE FISHERY, by Hiroshi Tominaga, Taiyo Gyogyo Kabushiki Kaisha, 4, 1-Chome, Marunouchi, Chiyoda-Ku, Tokyo, Japan.

DROPLINE FISHING IN DEEP WATER, by Ronald Powell, Government of the Cook Islands, Raratonga, Cook Islands.

Topic: Traps, Pots, and Dredges

EEL TRAPS MADE OF PLASTIC, by H. Mohr, Institut für Netz- und Materialforschung, Hamburg, Federal Republic of Germany.

TYPES OF PHILIPPINE FISH CORRALS (TRAPS), by Arsenio N. Roldan, Jr., and Santos B. Rasalan, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.

A NEW FISH TRAP USED IN PHILIPPINE WATERS, by Santos B. Rasalan, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.

LES MADRAGUES ATLANTIQUE ET SICILIENNE, by Vito Fodera, FAO/EPTA Fishery Adviser, Tunis, Tunisia.

KING CRAB POT FISHING IN ALASKA, by Robert F. Allen, Marine Construction and Design Company, Seattle, Washington, U.S.A.

Topic: Purse Seining

SONAR INSTRUCTION COURSES FOR FISHERMEN, by G. Vestnes, Fiskeridirektoratets Havforskningsinstitutt, Bergen, Norway.

RECENT DEVELOPMENTS IN ICELANDIC HERRING PURSE SEINING, by Jakob Jakobssen, Atvinnudeild Háskólans Fiskideild, Reykjavik, Iceland.

Topic: Deck Machinery

SOME SMALL STERN TRAWLERS, by E.C.B. Corlett, Burness, Corlett & Partners Ltd., Basingstoke, England.

THE APPLICATION OF HYDRAULIC POWER TO FISHING GEAR, by D. W. Lerch, Marine Construction and Design Company, Seattle, Washington, U.S.A.

THE COMPLEX MECHANIZATION OF BEACH SEINING, by S. S. Torban, Institute of Marine Fisheries and Oceanography (VNIRO), Moscow, U.S.S.R.

Topic: Controls

ADVANCES IN CENTRALIZED CONTROL AND AUTOMATION, by H. E. H. Pain, Marine & Navigation Division, S. G. Brown Ltd., Watford, England.

Topic: Fish Detection

DETECTEUR DEPOISSON "EXPLORATOR," by J. Fontaine, Compagnie générale de télégraphie Sans Fil (CSF), Paris, France.

A COMPREHENSIVE ECHO SOUNDER FOR DISTANT-WATER TRAWLERS, by G. H. Ellis, P. R. Hopkin and R. W. G. Haslett, Kelvin Hughes Division of S. Smith & Sons (England) Ltd., London, England.

ECHO-SOUNDING THROUGH ICE, by Tomiju Hashimoto, and Yoshinobu Maniwa, both of Fishing Boat Laboratory, Fisheries Agency, Ministry of Agriculture and Forestry, Tokyo, Japan; and Osamu Omoto, and Hidekuni Noda, both of Shibaura Technical Institute, Tokyo, Japan.

FREQUENCY ANALYSIS OF MARINE SOUNDS, by Tomiju Hashimoto and Yoshinobu Maniwa, Fishing Boat Laboratory, Fisheries Agency, Ministry of Agriculture and Forestry, Tokyo, Japan.

ECHO DETECTION OF TUNA, by Minoru Nishimura, Fishing Boat Laboratory, Fisheries Agency, Ministry of Agriculture and Forestry, Tokyo, Japan.

SECTOR-SCANNING SONAR FOR FISHERIES PURPOSES, by D. G. Tucker and V. G. Welsby, both of The University of Birmingham, Birmingham, England.

IDENTIFYING PACIFIC COAST FISHES FROM ECHO-SOUNDER RECORDINGS, by E. A. Best, Marine Resources Branch, California Department of Fish and Game, Menlo Park, California, U.S.A.

DETECTION ET LOCALISATION DES BANCS DE POISSONS, by Robert Lenier, President du Syndicat de materiél professionel des Industries Electroniques et Radio-Electriques, Conseiller des Pêches Maritimes, Courbevoie (Seine), France.

A NEW SONAR SYSTEM FOR MARINE RESEARCH PURPOSES, by T. S. Gerhardsen, Simonsen & Mustad A.A., Horten, Norway.

STUDY OF ACOUSTICAL CHARACTERISTICS OF FISH, by E. V. Shishkova, Institue of Marine Fisheries and Oceanography (VNIRO), Moscow, U.S.S.R.

BIO-ACOUSTICAL DETECTION OF FISH-POSSIBILITIES AND FUTURE ASPECTS, by G. Freytag, Institut für Netz- und Materialforschung, Hamburg-Altona 1, Federal Republic of Germany.

Topic: Fleet Operations

MOTHERSHIP FISHING FOR CRAB, by Nippon Suisan Kaisha, Ltd., Tokyo Building, Marunouchi, Chiyoda-ku, Tokyo, Japan.

TUNA LONGLINE MOTHERSHIP FLEET OPERATIONS, by Goro Okabe, Taiyo Gyogyo Kabushiki Kaisha, 4, 1-Chome, Marunouchi, Chiyoda-ku, Tokyo, Japan.

LAS PESQUERIAS ESPAÑOLAS AUSTRO-ATLAÑTICAS, by V. Paz-Andrade, Unión Española de Armadores Pesqueros, Vigo, España.

Subject: GEAR RESEARCH

Topic: Mechanical and Hydro-Dynamic Theory

THE THEORY OF DESIGNING FISHING NETS AND TESTING THEM IN MODEL, by Tasae Kawakami, Department of Fisheries, Kyoto University, Maizuru, Japan.

FISHING METHODS AND GEAR RESEARCH INSTITUTES: THEIR ORGANIZATION AND SCOPE, by A. von Brandt, Institut für Netz- und Materialforschung, Hamburg, Federal Republic of Germany.

THE DEVELOPMENT OF A MIDWATER TRAW P. Dale, Arbeidsutvalget for utvikling av Pelagisk båtstrål (APE), Bergen, Norway, and S. Moller, Di tor, R & D Section, A. S. Bergens Mekaniske Verk Bergen, Norway.

Topic: Instrumented Gear Testing

SOME JAPANESE INSTRUMENTS FOR MEAS FISHING GEAR PERFORMANCE, by Chikamasa and Kenji Ishii, both of Fishing Boat Laboratory, eries Agency, Ministry of Agriculture and Forest Tokyo, Japan.

TRAWL STUDIES AND CURRENTS, by J. N. C ruthers, National Institute of Oceanography, Goda Surrey, England.

PERFORMANCE OF THE GRANTON TRAWL, W. Dickson, Department of Agriculture and Fishe for Scotland, Marine Laboratory, Torry, Aberdeen Scotland.

TRAWL GEAR INSTRUMENTATION AND FULL SCALE TESTING, by J. Nicholls, Westland Aircra Saunders-Roe Division, Isle of Wight, England.

Topic: Fish Behavior Studies

SHRIMP BEHAVIOR AS RELATED TO GEAR R SEARCH AND DEVELOPMENT, by Charles M. Fu Jr., U. S. Bureau of Commercial Fisheries, Gear search Station, Panama City, Florida, U.S.A.

TUNA BEHAVIOR RESEARCH PROGRAM AT H LULU, by John J. Magnuson, U. S. Department of t terior, Fish and Wildlife Service, Bureau of Comm Fisheries, Honolulu, Hawaii.

EVOLUTION DE LA PÊCHE À LA LUMIERE D LES LACS AFRICAINS, by A. Collart, FAO/EPTA Economiste des Pêches, Cotonou, Dahomey.

UTILIZATION OF FISH REACTIONS TO ELEC ITY IN COMMERCIAL SEA FISHING, by Conradi Kreutzer, Smith Research and Development Co., I Lewes, Delaware, U.S.A.

THE USE OF AIR-BUBBLE CURTAINS AS AN TO FISHING, by Keith A. Smith, U. S. Bureau of mercial Fisheries, Gloucester, Massachusetts, U

AN EXPERIMENT ON THE DISPERSION OF C by Kentaro Hamashima, Nagasaki Prefectural Fis Experimental Station, Nagasaki, Japan.

PROBLEMS OF ELECTRO-FISHING AND THE SOLUTIONS, by Jurgen Dethloff, Intelectron Intern al Electronics GmbH, Hamburg, Federal Republic Germany.

THE IMPORTANCE OF VISION IN THE REACT OF FISH TO DRIFTNETS AND TRAWLS, by J. H. ter, B.B. Parrish and W. Dickson, all of Departme Agriculture and Fisheries for Scotland, Marine La tory, Torry, Aberdeen, Scotland.

THE IMPORTANCE OF MECHANICAL STIMUL FISH BEHAVIOR, ESPECIALLY TO TRAWLS, by C Chapman, Department of Agriculture and Fisherie Scotland, Marine Laboratory, Torry, Aberdeen, Sc land.

P FISHING FOR SAURY WITH LIGHT AND ELECTRIC CURRENT ATTRACTION, by I. V. Nikonorov, Institute of Marine Fisheries and Oceanography (VNIRO), Moscow, U.S.S.R.

Topic: Application to Fisheries of Recent Advances in Telemetry, Computer Science, etc.

PROSPECTIVE DEVELOPMENTS IN THE HARVEST OF MARINE FISHES, by Dayton L. Alverson, U. S. Bureau of Commercial Fisheries, Exploratory Fishing and Gear Research Base, Seattle, Washington, U.S.A., and Norman J. Wilimovsky, Institute of Fisheries, University of British Columbia, Vancouver, British Columbia, Canada.

AUTOMATIC DATA PROCESSING AND COMPUTER APPLICATION TO FISHERIES, by Benjamin F. Leeper, Univac Division of Sperry-Rand Corp., Baton Rouge, Louisiana, U.S.A.

MARYLAND PAN-FRIED OYSTERS

The home economists of the Bureau of Commercial Fisheries, Fish and Wildlife Service, U. S. Department of the Interior, recommend Maryland pan-fried oysters as a special treat for the family for their eating enjoyment.

- 2 cans (12 ounces each) fresh shucked oysters
- 2 eggs, beaten
- 2 tablespoons milk
- 1 teaspoon salt
- Dash pepper
- $1\frac{1}{2}$ cups dry bread crumbs
- $1\frac{1}{2}$ cups flour
- Lemon wedges
- Tartar Sauce

QUICK TARTAR SAUCE

1 cup mayonnaise or salad dressing

$\frac{1}{2}$ cup undrained sweet pickle relish

Combine mayonnaise and relish; mix thoroughly. Chill.

Drain oysters. Combine egg, milk, and seasonings. Combine crumbs and flour. Roll oysters in crumb mixture. Dip in egg mixture and roll in crumb mixture. (A commercial breading may be used. Follow directions on the package.) Fry in hot fat at moderate heat until brown on one side. Turn carefully and brown the other side. Cooking time approximately 5 minutes. Drain on absorbent paper. Serve with lemon wedges and tartar sauce. Serves 6.