Highlights of the Second World Fishing Gear Congress

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INTRODUCTION

ALTHOUGH THE 1963 World Fishing Gear Congress sponsored by the Food and Agriculture Organization of the United Nations was the second such meeting in recent years, there were several "firsts" recorded during the five days of technical sessions which ended on May 31.

Probably the most important "first" was the realization that the main key for survival of the fishing industry as a business proposition is the ability to catch fish cheaper through increased mechanization. Another "first" recorded at this meeting was the almost unanimous agreement that knowledge of the behavior of the species sought, rather than the behavior of the gear itself, was the most important factor in increasing the efficiency of present gear and developing entirely new fishing methods. This was borne out by the fact that of the 87 papers distributed at the start of the meeting on 22 separate topics, 17 were on fish behavior. I will briefly cover the highlights of the three main agenda items: (1) Materials, (2) Gear and Fishing, and (3) Gear Research.

MATERIALS

New net materials, knotless nets, and monofilament nets were the three subjects that received the most emphasis under this agenda item.

Whenever the subject of net materials is mentioned, I am sure it brings to mind nets made of synthetic materials. With regard to new net materials it appears that only one newcomer, polypropylene, has entered the fishing industry in the last couple of years. Encouraging experimental results with this material, as well as favorable reports of commercial trials in Japan, England, Germany, and the United States, indicate there is a good possibility that its use will increase in the near future. There is, of course, a very good reason why only one new synthetic net material has entered the fishing industry recently. When synthetic materials first appeared on the market, their efficiency was judged by comparing their properties with those of conventional natural fiber twines. Now, however, new net materials have to compete with high-class, well proven synthetic twines. Acceptance is, therefore, more difficult.

A striking example of a nation whose fishing industry has "gone synthetic" with regard to netting is Japan. In Japan the use of synthetics has increased steadily since they were first introduced for fishing nets in 1949. Use had risen to 21.2 million pounds in 1959 and 30.7 million pounds in 1961. There has been a corresponding decrease in the use of natural fibers for netting in that country—from 28 million pounds in 1949 to 10.6 million pounds in 1959, and 4.4 million pounds in 1961. Japanese synthetic fiber fishing nets are also being exported in increasing numbers. The total soared from 383,000 pounds in 1955 to 10.6 million pounds in 1961. The nets found markets in more than 100 nations. It was considered remarkable that whereas conversion to synthetics is about 85% complete for netting, about 90% of the ropes used are still of natural fibers. The statement that this must cause drying and preserving problems was left unanswered.

Knotted netting is still the main material used for fishing nets throughout the world, although knotless netting is becoming increasingly important.

There are two types of knotless netting; the Japanese twisted type, and the Raschel knitted type. In Norway, West Germany, Belgium, Peru, and the United States, nearly all of the increase in the use of knotless netting has been in the Raschel type. In Norwegian fisheries, use of this netting increased from 17 tons in 1960 to about 200 tons in 1962. Various advantages were reported, particularly in price. For example, at present prices in Norway, purse seines made from small mesh knotless netting are 25 to 30% cheaper than those made from knotted netting. With increasing mesh size, however, a point is reached beyond which knotted netting can be produced more economically. In Peru, 75 of the 1,200 purse seines now in operation are made of knotless netting. A new factory was recently established in Peru which will produce 400 tons of Raschel type knotless netting per year.

Monofilament netting, it was predicted, will play an increasingly important role in fisheries, particularly in gillnet fishing for species which are not already fully utilized. In Viet Nam, monofilament netting is already the most popular material for gill nets, outnumbering multifilament gill nets 8,000 to 160 (a ratio of 50:1).

It was emphasized that we must continually guard against generalizations concerning effectiveness of specific types of synthetics for gill nets or nets in general after experiments with only one type of fishing gear have been carried out. Certain qualities of the synthetic product may be undesirable for other types of fishing gear or for fisheries in other areas.

GEAR AND FISHING

Topics under the agenda item Gear and Fishing ran the gauntlet from bottom trawling through fish detection. It was generally recognized that the fishing industry is one of the last industries to mechanize. It was also recognized, after the various papers were reviewed and discussions held, that great strides have been made in the application of power and mechanization aboard fishing vessels. Although actual improvements in the fishing gear itself have been slower, continual progress in this field is being made.

An excellent example of a fishery progressing through use of mechanization and fishing gear improvement is the Alaska king crab fishery—the fastest growing industry in our northernmost state. This fishery produced over 50 million pounds from a fleet of over 200 vessels in 1962. The success of the fishery can be attributed to the efficiency of modern king crab pots and to the methods of handling the pots with gypsy winches or V-grooved hydraulic pot haulers mounted on a davit or boom. Pots measuring 7 feet square by 2½ feet, and weighing 200 pounds are commonly used. Some of these pots have contained over 200 crabs with a total weight of 2,200 pounds. An average of 50 crabs per pot, however, is considered good fishing.

Purse seining was discussed at considerable length, although only one paper on the subject was presented. The increasingly important role that this gear is playing in the development of fisheries throughout the world was strongly emphasized. Recent fishing efforts leading to important advances were reviewed in use of this gear off Iceland, Chile, Peru, South Africa, and our own United States, for various species of fish including herring, menhaden, anchoveta, and tuna. In some cases these efforts have resulted in the almost complete conversion from other fishing methods to purse seining. An example is the West Coast tuna purse seine fishery. In other cases efforts have resulted in modifications of existing purse seining techniques, such as the change from

the two-boat to the one-boat system in the Icelandic herring fishery and the adaptation of the power block to the two-boat system in the United States East and Gulf Coast menhaden fishery. Additional trends in this type of fishing include increasing use of horizontal scanning techniques (sonar or asdic) for locating deep swimming schools of fish, deeper nets, larger capacity vessels, several methods of controlling the ship alongside the seine, and stronger winches and supplemental equipment. Some of the problems recognized as requiring continuing attention were: increasing the efficiency of operators through additional mechanization; development of seines that can be fished on rough bottom; and, a fact which cannot be overemphasized, the need to adapt the purse seine principle to the local conditions characteristic of each species and each area fished. It was also emphasized that no single factor was responsible for the tremendous progress in increasing the efficiency of this gear, but rather a combination of factors.

Stern trawling discussions were centered around smaller vessels, particularly the highly mechanized 83-foot United States combination stern trawler-purse seiner NARRAGANSETT and the about-to-be-launched 99-foot English stern trawler ROSS DARING. The high degree of automation and extensive use of centralized controls will enable the United States vessel to operate with only three men, and the English vessel with five.

One should not get the idea that all in attendance agreed, especially at the start, that increased mechanization and centralized controls are good. Opposing arguments failed to convince the majority of us, however, that there are more important keys to the survival of the fishing industry as a business proposition, than additional automation which, when developed and adopted, will further increase the productivity per fisherman.

It was indicated that the best possibilities for a real breakthrough in increasing the efficiency of bottom-trawling gear is by applying electricity to the nets as described in the two United States papers on this subject—one on bottomfish gear and the other on shrimp gear. I am certain we will hear more concerning the electrical shrimp trawl soon.

Probably the most comprehensive trawl development program ever undertaken, at least according to some trawl experts, was initiated in 1959, as a cooperative venture between public and private agencies in England. The program was aimed at development of a distant water trawl having as its specific features: (a) increased headline height, (b) increased net mouth width, (c) sound structural design, and (d) improved handling qualities. The objectives set forth above were met in full, and a basic theory was reportedly developed from which gear answering certain other operating requirements could be designed. It was concluded, however, that it would be foolish to suggest that the achievement of given engineering objectives will necessarily permit fishermen to catch more fish. Perhaps we will receive a report of actual fishing experiments in the near future.

One of the most eagerly awaited papers on midwater trawls was not assembled in final form before the meeting adjourned. This was the paper concerning Japanese fishing efforts with this gear to catch shrimp in the east China Sea. It was reported that some 200 vessels are engaged in the midwater shrimp fishery. In single boat trawling, a 370-ton otter trawler uses a trawl with a 160-foot headline, whereas a pair of smaller bull trawlers working in tandem use a net with a 200-foot headline.

There was considerable discussion on one-boat midwater trawling for fish. It appears that, in spite of technically satisfactory performance, the catch results from one-boat midwater trawls for fish are generally lower than hoped for from a commercial standpoint. It is quite interesting that some of the most vigorous proponents of midwater trawls, who previously viewed this gear as a panacea for the ills of the bottom trawl fleet, now view them in a different light—namely to be used interchangeably with bottom trawls, when conditions require the use of one or the other types of gear.

There are two approaches underway concerning the development of midwater trawls—development of large trawls to be towed at low speeds and development of small trawls to be towed at high speeds. An extremely large trawl has been developed in the United States. Its utility as a gross biological sampling device is well established, but its use as a commercial gear is not.

Fish detection discussions indicated that horizontal and vertical echo sounders have been improved significantly in recent years. There is little doubt that efficient utilization of modern echo sounding equipment for detecting fish is becoming more dependent on specialized training than ever. In the Norwegian fisheries the need for training in sonar operation became an urgent matter several years ago, and suitable instruction courses were organized. It appears that the eight-day course should be lengthened somewhat, so that slightly more instruction could be given in the fundamental principles of sonar. The present course, however, has given the desired results with regard to classification and identification of echo traces. Delegates were reminded that echo sounding equipment is now more specialized in its capability, and it is important to obtain the correct equipment to fit the specific requirements of a particular fishery.

There was considerable concern expressed that not a single paper was prepared on airplane spotting as a method of fish detection. Discussions indicated that in Chile some operators felt that one spotter plane per ten vessels worked very well. Spotting techniques in the United States menhaden and tuna fisheries were not discussed.

Fleet operations involving motherships, although certainly not new, were the subject of considerable discussion. I am sure we are all familiar with the fleet operations utilizing dories in the northwest Atlantic, which, although initiated some 300 years ago, are still being conducted by the Portuguese. The majority of the fleet enterprises discussed, however, were those of fairly recent origin, including the king crab and tuna operations of the Japanese. It was pointed out that, although there has been a distinct trend among European nations toward operations utilizing independent freezer trawlers and factory trawlers rather than motherships, this method has not proved successful in all cases. For example, in 1961 and 1962, the Spaniards carried out distant water trawling operations with large self-contained freezer trawlers, off South America and South Africa. Because of the great distances involved (4,500 to 5,000 miles), requiring considerable running time, they have recently initiated a mothership type operation in the belief it will be a more efficient undertaking. It was obvious from the discussions that successful fleet operations require a complete exchange of information among catcher vessels, so that each is working for all.

GEAR RESEARCH

The importance of fish behavior in development of fishing gear and the

influence of fish behavior on fishing operations is further emphasized by the fact that over one-half of the papers relating to gear research were on this subject. Even so, it was quite evident from the discussions that gear technologists, net manufacturers, and fishermen must constantly be reminded that in their considerations of the best design, rigging, and operation of fishing gears, more emphasis should be placed on the behavioral properties of the species sought. In the past this has been neglected because emphasis has been placed on the physical and engineering properties of fishing gear and the behavior of the gear itself. The new developments presented in commercial fishing related to the use of air-bubble curtains for guiding and driving herring and, on the experimental side, aquarium experiments on fish behavior and efforts to observe the reactions of fish to gear in the sea. It was pointed out that behavior of fish as related to their horizontal and vertical distribution is the most important factor in locating them and determining where and when to fish. Vertical distribution and the behavioral responses of the fish to fishing gear were considered connected primarily with how to fish.

Results were reported of various experiments regarding the behavioral responses of fish to gear and controlled artificial stimuli. Experiments involving the reaction of commercially important marine species such as herring, cod, whiting, and haddock indicate that of all types of stimuli produced by stationary and moving gears, the visual ones are the most important in determining the efficiency of fish capture. 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, at about the same vertical level. There is no clear evidence of their avoiding the gear by moving upwards. In midwater, avoidance of pelagic trawls sometimes takes place by the fish moving downward. In darkness, these responses do not appear to take place, and orientation and movement away from the gear are much less pronounced.

It was shown that a large body of information has been assembled from experiences of fishermen and scientific investigators on the general behavior patterns of the main commercial species. But there are still many unknowns concerning the detailed behavior responses of fish, both to natural environmental and artificial influences. We can expect more emphasis to be placed on behavioral experiments in the natural habitat of the species studied in contrast to past work, the majority of which has been done in tanks ashore.

Mechanical and hydrodynamic theory discussions dealt with the basic theories of towing fishing gear, primarily bottom trawls, through the water. Various studies conducted in Japan, Norway, and England on the resistance of netting, trawl doors, and trawl warps, and the introduction of several technical procedures for determining the proper vessel requirements for towing a trawl net of a certain size were discussed in detail. The information presented, although of a very technical nature, indicated significant advances in this field.

Instrumented gear testing discussions included details of various types of instruments and instrument complexes for measuring the behavior of trawl gear. It is significant to report here that gear instrumentation is approaching the stage of development where we can expect certain practical instruments for monitoring the gear to be available to commercial fishermen in the near future. These include on-bottom indicators, codend load indicators, and automatic positioning and control devices for midwater trawls.

Future harvesting methods and the possible applications of the high-speed computer and associated elements of automatic data processing to the fishing industry were the last subjects discussed. It was reported that at least one United States fishing company is currently using computer techniques, and high-speed digital computers are being used by some shipbuilders.

Future harvesting methods were discussed in a conservative way, which is only natural in an industry internationally famous for its conservative attitude. The engineering technologies of the industrial, military, and space fields were explored and assessed as to their possible application and use for improving existing harvesting methods or developing new concepts for harvesting. These considerations were limited to the next three decades and it was emphasized that science fiction has perhaps already anticipated most of them. Those discussed included: retrievable floats with built-in detection systems that would automatically signal to catcher vessels the presence of fish; artificial logs for attracting fish with built-in detection systems for automatically signalling catcher vessels when concentrations of fish were present; a network of buoys to detect fish and transmit data through satellite telemetry to a shore-based "hydro-central" for computer analysis and transmission of data summarized by facsimile techniques to fishing centers; motorized units which would replace otter boards; and remote-controlled, self-propelled midwater trawls. Also discussed were the possible applications to fishing vessels and gear of lightweight materials developed for space vehicles.

In closing, I wish to emphasize that it was made clear at the Gear Congress that many of the countries that operate extensive fisheries are beginning to take advantage of the advanced technical knowledge existing in many counterpart industries ashore. From the information passed on to us, however, it appears that the advances so far in fisheries technology for which the industry can be justifiably proud, are only a scratch on the surface of the potential we have at our finger tips.

Industry Trends and Indicators of Economic Performance In the Menhaden Fishery

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Abstract

This paper deals with economic elements underlying the growing relative importance of the Gulf Coast menhaden fishery and the degree to which both the Atlantic and the Gulf fisheries fulfill basic economic objectives of performance.

An extremely high degree of physical output per unit of labor and capital input has characterized the Gulf fishery since 1954 and has been a basic factor in the development of this fishery.

The analysis of available data indicates that both Atlantic and Gulf menhaden