INSTRUMENTS AND DATA AQUISITION SYSTEMS FOR RESEARCH ON TRAWL NETS

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INTRODUCTION

Catching methods and ways to improve them have been engaging the attention of fishermen from time immemorial. This was done mostly by trial and error methods, as most of the earlier investigations were primarily directed towards solution of biological problems related to fisheries. In recent years several fisheries laboratories have taken up studies on the working principles of many gears such as trawls, gill nets, round haul nets etc with the aid of instruments developed for the purpose. The purpose of this article is to review the progress made in this field and in the development of telemetering instruments and continuous data aquisition systems.

The fishing gear is a hydrodynamic system the behaviour of which is controlled by many hydro-dynamic factors, important ones among which known to affect the functioning of a trawl net being (1) vertical opening, (2) horizontal opening, (3) depth of operation, (4) tension on the warp, (5) resistance to motion of the different parts, (6) angle of attack of the boards, (7) tilts in the boards, (8) mesh shapes at different parts of the net, (9) water flow around and inside at different parts of the net, (10) tension at the cod-end due to the catch in the net, (11) curvature at the foot ropes and head ropes, (12) magnitude and direction of the water current and (13) speed of the boat. By far the most reliable method for assessing the performance of slow moving systems such as trawls is direct observation. Specially trained divers (frog-men) are used in several countries for studying the working of trawls and similar gear. Underwater photography and under-water television are more recent methods. Since light is easily absorbed in water and is

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processing, chosen with discretion, to get an end product of uniform quality.

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insufficient for illuminating objects which are not very close to the camera, some new developments have been made in under-water television replacing light by ultrasonic waves.

Instrumentation:

Under-water instrumentation is comparatively more difficult because of the various restrictions in their design and operation. Weight, bulkiness, power source etc become very significant in the case of underwater measurements. The instruments attached to a net in particular should be very light and small in size so that the performance of the net is not affected by their presence. The instruments should be capable of withstanding rough handling. The power source required for the ultrasonic type transmitting instruments is yet another problem, in that the power consumption has to be kept at a minimum. Although many advanced and efficient techniques suitable for other fields are known, these cannot be adopted in under-water instruments and hence special methods are required to be evolved.

The instruments so far developed include (i) mechanical under-water recording type, (ii) wire telemetering and (iii) wireless ultrasonic telemetering types. In addition to their being heavy and bulky, the main drawback of the underwater recording instruments is that the information can be obtained only after hauling the gear. The wire telemetering types possess the advantage that their sensors fitted on the net are small and light and hence several of them can be used at a time. But the major handicap is the difficulty in handling the cable. The wireless ultrasonic transmitting type instruments are of recent origin and are easy to operate. They are relatively heavier than wire telemetering types. Further, there are apparent difficulties in measuring most of the parameters of the fishing gear in this method and hence their use is limited only to a few of the above said hydrodynamic parameters. Moreover, the echoes of the ultrasonic signals from the bottom, water surface etc cause errors in the measurement and are still unsolved problems in underwater wireless communication.

Telemetering instruments for instantaneous measurements:

Telemetering instruments provide instantaneous measurements of the parameters. Ultrasonic waves are the only wireless means of communications under water as electro magnetic waves and light waves are easily absorbed in sea water. Ultrasonic waves have the advantage that they can travel longer distances in water at a speed five times that in air. But the production of ultrasonic waves is much more difficult compared to production of electro-magnetic waves and hence communication under water is more difficult than in air. The range of transmission of ultrasonic waves is very much limited (a few kilometers) while that of electro-magnetic waves in air and space can easily travel several thousands of kilometers. During the last decade several wire and wireless telemetering instruments have been developed. The contributions made by the Marine Laboratory, Aberdeen, White Fish Authority, U. K., Fisheries Research Board of Canada, National of Institute of Oceanography, Surrey, Fishing Boat Laboratory Japan, Bureau of Commercial Fisheries, U. S. A. and West Land Air Craft Ltd., U. K. are worth mentioning. Recently in India, Central Institute Fisheries Technology has developed wire telemetering instruments for the measurements of depth of operation, angle of attack of otter boards, tilt of otter boards, fore and aft tilt of otter boards, underwater tension for the measurement of the resistance to motion of the different parts of the net during operation, mesh size variations and water flow around and inside the net.

Commercial firms like Furuno Electric Co., Japan, Kode Electronics Ltd., Japan; Titran Electronics Co., Japan etc have developed and marketed ultrasonic equipments for the instantaneous measurement of the depth of operation, vertical opening of trawls, recording and counting of fishes entering the net etc.

Continuous multichannel data acquisition systems:

Many of the hydrodynamic parameters are inter-dependent and it will be more valuable to obtain at least the most important of them simultaneously and instantaneously. Telemetering instrumentation is the only way of satisfying these conditions and many fishing research institutions all over the world are engaged in the development of multichannel data acquisition sytems. Foster (1966) described a fully instrumented gear for measuring the important parameters of the trawl. White Fish Authority, U. K., in co-operation with a commercial firm has developed a multichannel ultrasonic link between the net and the boat. This system measures (i) water temperature at the sea bed, (ii) head line height (vertical opening), (iii) net mouth spread (horizontal opening) and (iv) strain in the head line legs of the trawl (underwater tension). The system is also provided wi h a calibration channel for checking the normal working of the transmitter. The details of the working of the system are described elsewhere by Hearn (1966). Mowat (1966) describes the working details of a digital acoustic telemeter for fishing gear research.

The data from the various telemetering units received in the form of continuous analogous or digital forms can be displayed in a meter or stored in either continuous paper recorders or tape recorders. These data are processed for obtaining the best working conditions of the trawls. Johr (1966) describes the attempt made in Norway in the wireless data acquisition system in fishing gear research. They have succeeded in measuring the tensile loads in the warp before and after the otter board, depth of the otter board, the three position angles of the otter board, distance between the two otter boards and net opening. The data are converted to electrical signals by suitable transducers. The signals are time multiplied and sent to an analogue-to-pulse frequency converter, the output pulses of which control the transmitter of the ultrasonic telemetry link.

Data processing with the help of Computer:

Data processing is equally important as instrumentation. The data are processed both for studying the effect of each individual part as well as for deciding the performance of the fishing gear under the various known and diverse circumstances. Computors are used for quick analysis of the data from the several instruments used. The data already obtained from the various instruments working on different principles are to be converted to a uniform digital form for feeding the computor, which is achieved by using analogue-digital electronic converters. The marine laboratory in Aberdeen used an electronic computor for gear research works especially developed by Elliot Bros as per the specific requirements (Anon, 1970). This computor contains a "data logging programme" of 6000 seperate instructions for the control of the system. Informations from 16 instruments on the net were first brought to a telemeter control unit on the net and they are transmitted to the boat ultrasonically. Such types of computors are now in use in many other fields of marine engineering especially in automatically controlling the functions of the ship, navigation and also in designing the ships.

Conclusion

The new approach in fishing gear research includes as an important part the study of the fishing gear. Electronic telemetering instruments have proved to be the primary requisites for the study of the hydrodynamic parameters of the fishing gear. For an effective study and the development of more efficient fishing gears the field of instrumentation has to be further extended with a view to feeding the informations to the modern high speed computors for speedy and accurate analysis of the data. Just like in other fields of physical sciences, there are all possibilities of studying the basic properties and parameters of the fishing gear and developing the same with the help of electronic instrumentation, controls and data processing.

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