ELECTRONIC EQUIPMENTS FOR SAFETY AND EFFICIENCY IN TRAWL FISHING

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[The author describes some of the electronic instruments required in trawlers for the safety, efficient operation and control of the gear and the vessel. Electronic equipments for fish detection, navigation and communication are not included here.]

When the trawler became more and more sophisticated with equipments for easy and efficient operation, it started creating problems regarding their optimum exploitation. The modern trawler has got many mechanical, electro-mechanical and hydraulic machinaries on board the vessel as well as the fishing gear in the ground of operation. The measuring and control devices described here are intended for facilitating the optimum and the most efficient utilisation of the fishing gear and those mechineries. For this purpose the skipper has to get certain vital informations about the operating features of his trawler as well as that of his gear system under water. Apart from theoretical interest, there are important factors like trawl depth, warp load, net load, boat speed etc. which have got direct and immediate effect on the safety and efficient utilisation of the whole system.

Trawl depth meter for controlling the net in mid water operations

Trawl depth is the actual depth where the trawl net is in operation. For bottom trawling, the trawl depth and the depth of bottom are the same. Hence sonar equipment like echosounder provides the information directly. The application of trawl depth meter is mainly in mid-water trawling operations. Since the country is planning to expand the fishing activities to deeper waters, the equipment is becoming an essential part of successful commercial operation.

In mid-water trawl operations, the net is to be positioned between the surface and the bottom. For the maximum efficiency of operation of the net, it

should intercept the fish shoals, which are detected by the vertical sounding echosounder. The position of the net can be brought exactly to the depth where shoals are detected by altering the warp length. But the exact position of the net should be known during operation. Based on the length of warp released and the speed of the boat, the position of the net is obtained approximately. This approximation is insufficient to meet the requirements of controlling the net properly.

The commercial equipment for the measurement of trawl depth is called 'net-sonde' marketed by Furuno Electric Co., Japan. This is a wireless telemetering type instrument which measures the trawl depth in terms of hydrostatic pressure. The depth is obtained in either a recorder or an indicating type meter.

Echo sounders with certain additional facilities are also utilised for this measurement. The water depth and the depth from the net to the bottom are simultaneously obtained by using two transducers, one in the boat and the other at the head rope of the net directed downwards. The difference between these two gives the trawl depth. A special broad plank is required at the head rope for mounting the transducer and directing it downwards, in addition to the long shielded and sheathed thick cable for conveying the signals from the net to the boat. This arrangement provides additional informations about the opening of the net and the fishes entering it. As the first 2 to 3 metres of distance from the transducer is marked blank, the measurement of the mouth opening and the observation of the fishes entering are possible only for large nets where 2—3 metres of distance is negligibly small.

The trawl depth is also directly measured by means of echo-sounder with a transducer mounted at the head rope and directed vertically upwards. The waves get reflected from the surface. In modern fishing trawlers, three echo soundings are simultaneously made with three separate transducers one in the hull of the vessel for usual fish detection and the others at the head rope of the net directed vertically up and down for measurement of trawl depth and observation of mouth respectively.

The operation of the instruments mentioned above are comparatively difficult because of the special arrangements required for directing the ultrasonic beams to the required directions. Recently, Central Institute of Fisheries Technology has developed a trawl depth meter which is claimed to have many advantages over the above types. It is very light and small and can be either suspended or tied to the net or otter board in any direction. Because, this instrument senses the depth in terms of the hydrostatic pressure which is directly proportional to trawl depth. Since hydrostatic pressure at a depth has no direction, sensor does not require directivity.

Observation of the trawl mouth and estimation of the catch in the net

There are specialised instruments for observation and estimation of the catch in the net other than that used by means of the transducer of the echosounder attached to the head rope. Furuno Electric Co., Japan and Koder Electronics, Japan have marketed wireless telemetering type equipments named 'net recorder' and 'net monitor' respectively. The operation of these instruments is much similar to that of echosounder. The transmitter attached

to the head rope has got two acoustic transducers, one directed downwards while the other is directed to the boat. The first transducer sends ultraonic beam of higher frequency and gets the echos from the foot rope, bottom and the fishes, while the second transmitter sends ultrasonic beam of lower frequency modulated by the signals obtained from the first. The receiver in the vessel displays them in arecorder, the stylus speed of which can be altered and synchronised to the pulse rate from the transmitter.

'Simrad' has developed equipments for estimating the catch in the net based on the reflections obtained through echo sounder observations, named 'echo integrator'. The echoes are added and displayed in a continuous recorder as an ascending curve. 'Titran Electronics', England, has marketed a similar one with its echoes added and displayed in digital form, named 'fish counter'.

Warp Tension meters for safety of the gear and Optimum gear selection

Warp tension meters provide accurate informations about the load of the boat in terms of resistance to motion of the whole gear system. This information obtained in terms of so many Kgs. of tension, helps us to find out the defect of the net, unequal distribution of load on the warps, optimum size of the net for a particular boat, entangling of the net at the bottom etc. In general, there are two types of tension meters based on their position of measurement named 'on board tension meter' and 'under water tension meter'.

(a) **On board warp tension meter**

The instrument attached to the warp in between the winch and the gallows measures the entire load of the trawl including the warp. Often times the selection of the net is done based on arbitrary assumptions. In the absence of sufficient information about the load of the net, the boat is often times overloaded or under loaded. Further, continuous observation of the tension on both the warps will provide instantaneous informations about the faulty operation. Because, all such cases appear as tension on the warp. Unequal distribution of the load on the warp indicates defects on the gear or surroundings such as unequal release of warps, heavy underwater current transverse to the motion of the net, one of the otter boards ploughing into the mud etc. A sudden decrease in tension appearing on both the warps indicates a torn condend. A sudden increase in tension can be due to entangling the net on the ground. Any serious of defects such as breaking of one of the warps at any stage etc. will be indicated easily by large changes in tension from the maximum to the minimum.

There are portable and ship installed type tension meters. In smaller trawlers installation of permanent tension meters are rather difficult and impracticable. Because, permanent installation types require a portion of the rope on the deck which keeps its position fixed irrespective of the warp length paid or load of the net. In smaller trawlers, usually the warp goes straight from the winch to the net through the gallows. The warp in between is not steady because diameter of winch drum changes at one end of the warp while the gallow swings during operation at the other end. In larger trawlers usually a portion of the warp is available steady since the warp does not go straight from the winch to the gallow. For convenience of handling, the warp is taken over pulleys which are fixed on the deck. The warp in between these pulleys is fixed. Tension can be measured easily and conveniently at this

position of the warp by installing a tension meter permanently.

'Ship-installed' tension meters are installed on the deck without making any disturbance to the routine operations in the vessel. As the arrangements on the deck are different from vessel to vessel, ship-installed tension meters are to be designed based on the particular arrangements in the vessels, even though basic principle may remain the same.

Several firms have manufactured portable and ship installed type tension meters. Because of many conveniences strain gause type transducers are used for sensing the tension. Electronic tension meters with many additional facilities and controls are available now. Continuous recroding of the signals helps their easy interpretation. Warning alarms are incorporated in some of these instruments against over loading of the gear which helps the skipper to save the costly gear.

b. Underwater tension meter :

While, on board tension meter measures the entire load of the gear including the warp, the under water tension meter measures the resistance to motion of each individual component of the otter trawl such as the otter boards, net etc. These measurements help one to analyse the gear in terms of the distribution of load to the different parts and thus to find out the defects, if any.

The resistence to motion of the net, otter boards etc: are measured in terms of so many kgs. at the respective positions on the warp. The tension at the rigging point between the otter board and the net corresponds to the combined resistance of otter boards and the net while the tension between the net and the otter board gives that oi the net alone. The latter reduced from the former, gives the tension of the otter board alone. Most of the instruments available are under water recording types where the informations are obtained only after hauling out the net. A telemetering type instrument has been developed in Central Institute of Fisheries Technology This instrument measures the instantaneous values of tension and displays them in an indicating meter on board the vessel.

Boat speed meter for better control and safety of the vessel

Speed of motion is the foremost important factor of all moving objects whether in water, land or space. Measurement of speed of motion of the vessel is an important criterion as this is always considered at any stage of the operation of the gear. It has got direct bearing with almost all working features of the vessel and the gear.

As far as moving objects on land are concerned there is only one speed. The measurement of the speed is very easy in vehicles with wheels, as their wheels are in slipless contact with the ground. There are two speeds for bodies moving in water namely relative speed and actual speed (relative to earth). For many practical purposes, relative speed has got more significance and usually this is indicated as the speed of the vessel.

a) *Relative speed:*

Since the propeller is liable to slip in water, the speed of engine or propeller cannot be computed for the measurement of the relative speed of the vessel. But when the boat and its load remain unaltered, propeller revolution has got relation to the relative speed to a great extend. The relative

speed is measured by sensing the water displacement with respect to the sensing probe exposed to the water, The most popular principle is to employ a light propeller for converting the speed into its r. p. m. The resistance to motion offered by a small lever projected to water is also accepted as the basic principle for sensing the speed. The most modern type speed meter works on the principle of electro magnetic pick up of the speed. The speciality of the sensor of this instrument is that it is flush mounted on the hull.

All the speed meters availables at present require calibration along with the vessel in which it is fixed, if the sensor is permanently fixed on the hull. Because, the instruments sense the speed near the hull. The speed and nature of flow at the surface of each vessel are different, depending upon the shape and nature of the hull. Instruments already calibrated for stream line flow outside the disturbances produced by the movement of vessel are also available. They require long roads for mounting the probe sufficiently away from the water disturbances produced by the vessel.

b) *Actual speed of the vessel:*

This is the speed of the vessel with respect to a fixed point on the ground. The measurment of this speed is necessary to estimate exactly the distance covered during trawling. The relative speed and actual speed coincide when the water is still. There were no instruments for the measurement of this factor until very recent times. Marconi International Marine Co. has developed a sonar type equipment for this measurment. By measuring the doppler shift of sonar beams reflected from the sea bed, the equipment measures the vessel's velocity relative to the bottom over which it is moving. This is called 'sonar docking system' as it is mainly employed in large vessels for easy and accurate docking avoiding many docking accidents caused by misjudged velocities.

There are many other instruments such as rudder position indicator, engine temperature monitor, bilge water alarm, smoke alarm, fibre alaram etc. which have general applications in ships of any type. The wide potentialities of electronics has made it to enter into almost all sciences and technology with further scopes for rapid and easy developments. ●