Electronic Wire Telemetering Instruments for Engineering Studies of Otter Trawls

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The paper reports wire telemetering instruments for the measurements of depth of operation, angle of attack of otter boards, tilt of otter boards, under water tension for the measurements of the resistance to motion of the different parts of the net during operation, mesh size variation and water flow around and inside the net.

The recent developments in electronics and instrumentation made it easy to measure the performance of fishing gear with remote sensing electronic devices. The instruments so far developed include (i) Mechanical underwater recording type (ii) Wire telemetering (iii) Wireless ultrasonic telemetering type. The main drawback of the underwater recording instruments is that the information can be obtained only after hauling the gear. The wireless ultrasonic transmitting type instruments are of recent origin. The main advantages are that the information are obtained simultaneously and that no wire connections are required. But the instruments are bulky, heavy and expensive. Moreover the echoes of the ultrasonic signals from the bottom and water surface cause errors in the measurement. The wire telemetry is another method used for data collection. Here the advantage is that the sensors are fitted on the net which are small and light and hence several of them can be used at a time. During the last decade several wire and wireless telemetering instruments have been developed. Hamuro & Ishii (1964) in Japan developed a heavy and large recording instrument for obtaining the depth of operation of the gear on a rotating paper drum. The main drawback here is that the measurement is obtained after the gear is hauled up. Sivadas (1968) developed a mercury fitted transducer for the above measurement. Sivadas (1969) has also developed an electroinc instrument using solid state components. This instrument has got the additional advantage that the range of operation can be altered conveniently.

There are different and contradicting opinions (De Boer, 1959) among the research workers and technicians regarding the total resistance to motion of the gear system in relation to catch. The underwater line tension meters described by de Boer (1959) Hamuro & Ishii (1964) and Nicholls (1964) are all based on hydrostatic principles, while the one developed by Carrothers (1966) is an electronic type using semi-conductor strain gauges. All the above types are heavy and bulky and the natural performance of the gear system is affected by them and the information required can be obtained only after hauling the gear. The electronic type-under water tension meter developed by Sivadas (1970) using solid state components is comparatively light and rugged and information are fed to the boat instantly.

The mechanical underwater self recording clinometer developed by de Boer (1959) is too heavy and bulky for a medium sized trawl net. The tilt meter developed by Sivadas (1969) is a telemetering type instrument with compact, light and rugged transducer Hamuro & Ishii (1964) have made an underwater recording type mechanical instrument for the measurement of the magnitude of the water flow inside the net. Sivadas (1969) had made prototype very light inductive type water flow transducer along with a solid state electronic indicating meter for measurement.

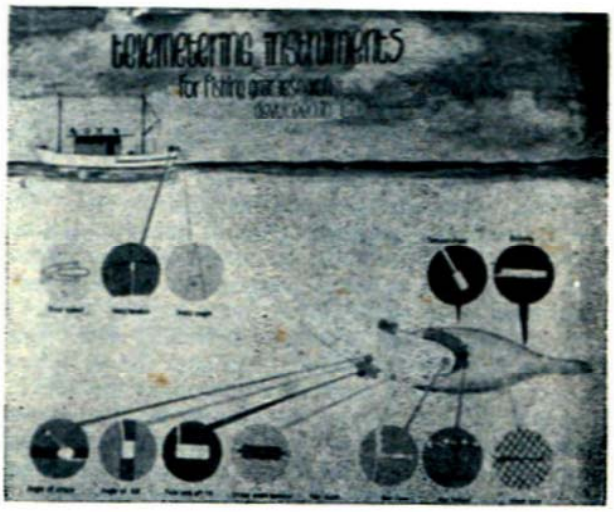

Fig. 1. Telemetering instruments for fishing gear research

The paper reports wire telemetering instruments for the measurements of depth of operation, angle of attack of otter boards, underwater tension for the measurement of resistance to motion of the different parts of the net during operation, mesh size variation and water flow around and inside the net (Fig. 1)

1. *Trawl depth meter*

This wire telemetering instrument monitores the depth of operation (trawl depth) of trawl net during fishing operations by means of its hydrostatic depth sensors mounted on the net and an electronic meter on board the vessel. The meter displays the depth in meters (Fig. 2).

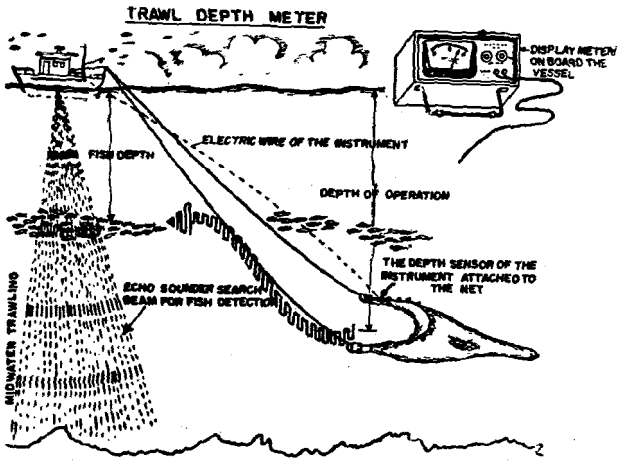

Fig. 2. Trawl depth meter

Midwater trawling can be carried out effectively only by aiming the trawl net to the moving fish shoals. The information needed are location of fish shoals and the exact depth of operation of the trawl net. The trawl net can be properly guided to the depth where fish shoals are detected by controlling the warp length paid out or the speed of the boat. While fish depth is obtained from echosounders, trawl depth has to be obtained by means of specialised instruments. There are instruments available abroad namely, netsonde, netprobe and net-monitor employed for this purpose. The trawl depth meter is designed to suit our special requirements of smaller underwater sensing probes for easy and convenient operation in smaller nets. Looking into the meter the skipper can alter the warp length or speed of the boat conveniently to make the trawl net intercept the fish shoals. In bottom trawl operations, it enables to keep the net just to slide over the bottom properly with the correct length of warp. Apart from its commercial use, trawl depth measurements are required during the design, development and standardisation of trawl nets for ensuring proper scope ratio. The following are the features of this instrument.

Range	0–100 m (can be altered conveniently to other ranges)
Accuracy	± 1%
Power required	9 V self contained dry cells with 35 mA consumption
Weight in air of the depth cells	Less than 800 gm
Cost	Rs. 3800

2. *Underwater tension meter*

This wire telemetering instrument measures the resistance to motion of different components of the otter trawl system underwater. These measurements are required to estimate whether the total load is distributed properly along the trawl net, otter boards and wire rope.

The instrument consists of an underwater tension sensor and an electronic meter on board the vessel, both being connected by a long two-core cable. The tension transducer mounted between net and otter board senses the load of the net; while that mounted, between otter board and wire rope senses the combined load of otter board and the net. The load of otter board alone can then be estimated by noting the difference (Fig. 3).

Range	0–500 kg, 0–100 kg (other ranges can also be made)
Accuracy	± 1%
Depth limit	100 m
Power required	35 mA at 9 V (self contained battery)
Cost	Rs. 3,900/-

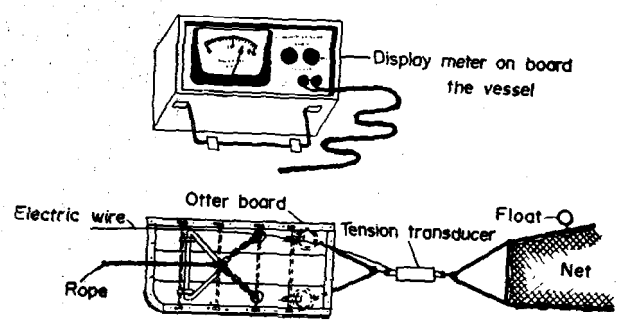

Fig. 3. Schematic diagram of underwater transducer between otter board and net.

3. *Tilt meter*

This wire telemetering instrument monitors the tilts of the otter boards namely, side way tilt and fore and aft tilt by means of its tilt transducer mounted on the otter board and the electronic meter kept on board the vessel, both being connected by a two-core wire. These measurements will help us to assess the stability and efficiency of different types of otter boards and nets combinations, defects in the operation of the otter boards

etc. The design and rigging of otter boards can be improved for better performance of the system by monitoring these parameters during the relevant R & D works.

Features:

Range	–45° to + 45° (both tilts)
Accuracy	± 2°
Depth limit	100 m
Power	9 V self contained dry cells at 35 mA
Cost	Rs. 3,200/-

4. *Angle of attack meter*

This instrument measures the angle of attack of otter boards during operation and estimates the stability, and suitability of otter boards under different rigging conditions.

The instrument consists of an underwater transducer and an electronic indicating meter on board the boat, the two being connected by an electric cable. The sensor converts the angle of attack into electrical signals in the form of changes of inductance of an electrical coil. The transducer is mounted at the top edge of the otter boards for sensing the angle of attack and its fin aligns itself to the direction of relative water flow caused by the movement of otter board. The light and rugged type sensor mounted on the otter board does not affect its normal operation.

Features:

Range	0–90°
Accuracy	± 2°
Transducer	400 g
Power required	9 V self contained dry cells
Cost	Rs. 2,800/-

Mesh distortion telemeter

This wire telemetering instrument measures the diagonal distance between a few meshes at different required parts of nets during operation. This information is used to estimate the actual dimensions, shapes and thus to estimate the distortions of meshes during operation. It further leads to better understanding of the excess stresses and strains developed at different parts of the net.

The instrument consists of an electronic meter kept on board the vessel and a light and compact mesh sensor mounted on the net both being connected by a 2 core cable. The transducer senses the mesh variations and converts them into electrical signals, while the meter on board the vessel displays them in the required form.

Features:

Range	24 to 48 cm (diagonal distance between a few meshes)
Accuracy	± 1 mm
Power	9 V dry cells with 35 mA current
Sensor	very light and rugged sensor without causing any distortions to the net
Cost	Rs. 2,800/-

Catch telemeter

This instrument measures catch in the net during operation. The single tension sensor on the mouth of the cod-end picks up the catch signals in terms of the resistance to motion of the cod end, while the meter on board the vessel displays the catch proportionally. The meter can give only a very approximate information as its reflections will depend on the speed of trawling, the type of cod end, type of fish caught etc.

Features:

Range	0–50 kg, 0–100 kg
Accuracy	15% of the range
Weight of the sensor in air	200 g
Power	9 V DC
Cost	Rs. 4,500/-

Net-flow meter

This instrument is meant for monitoring the speed of water flow inside trawl nets where usual flow meters cannot be used.

The instrument consists of a light rotor type transducer mounted inside the trawl net by means of two ropes tied to the foot rope and head rope. The flow signals from the transducer are conveyed to the meter on board the vessel, through two core cables. The information is displayed in a digital meter.

Features:

Range	0 to 200 cm sec^{-1}
Accuracy	± 1 cm sec^{-1}
Weight of sensor in air	400 g
Power	9 V dry cells with 35 mA current
Cost	Rs. 4,000/-

Universal marine telemeter

For making the data collection simpler, CIFT has developed another electronic indicating meter namely, universal marine telemeter for displaying all the information one by one in a single meter. This

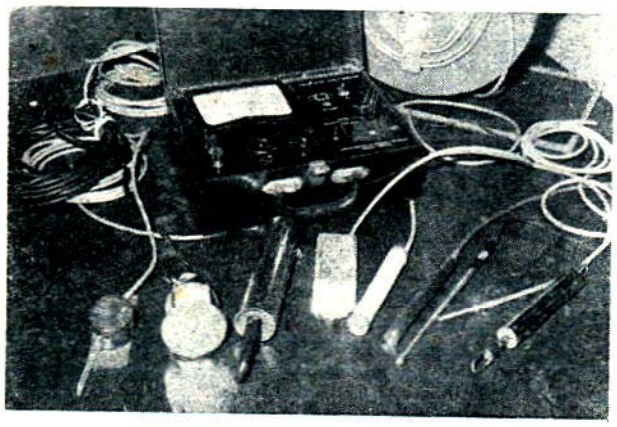

Fig. 4. Universal marine telemeter

has reduced the complications and difficulties of handling several instruments on board the vessel. Fig. 4 shows the various transducers along with the single display unit.

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