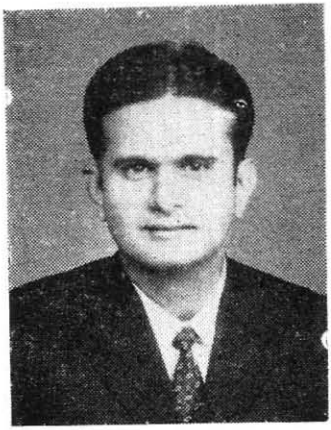

Modern Trends in Fisheries Technology in the United Kingdom

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A visitor to the Fisheries Laboratory Lowestoft, U. K. cannot fail to be impressed by the significant strides made by the Institution in fisheries research. Of particular interest are some of the tools of research, either developed or adopted there for gear research, fish detection, and estimation of plankton. They are the Electronic Sector Scanning Sonar, the Transponding Acoustic Fish Tag and the Multi-purpose High-speed Plankton Sampler. At a time when Fisheries Scientists and Administrators in India are unanimous in their efforts in the search for fresh concepts in basic research in Aquatic Biology and in Fisheries Technology, it would be hardly necessary to mention that introduction of these tools in India would ensure efficiency and economy in human effort and give a fillip to our research in Fisheries Technology. The advantages that would accrue from these efforts would, very likely, more than offset the very high initial expenditure involved in the procurement of these equipments.

Electronic Sector Scanning Sonar (Fig. 1)

The installation of a complex Electronic Scanning Sonar known as the A. R. L. (Admiralty Research Laboratory) Scanner in a fishery research vessel, its

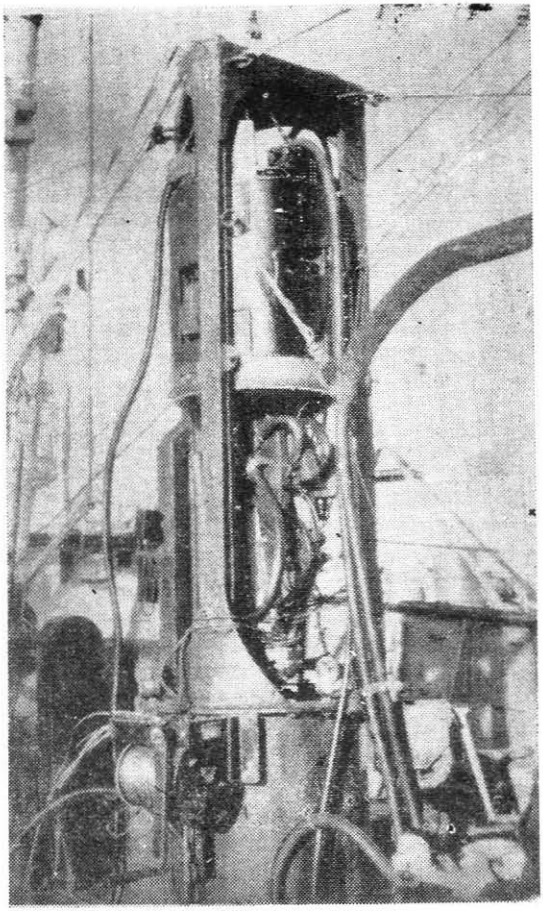

Fig. 1. Electronic Sector Scanning Sonar fitted on R. V. *Clione* of the Fisheries Laboratory, Lowestoft.

mechanical performance, diagrammatic description, mode of operation and its uses are dealt with in detail by Mitson and Cook (1971). Applications of this instrument include fish detection and fish behaviour studies, observation of trawls both in midwater and on the sea bed, detection and classification of wrecks and studies on sand waves and other sea bed features including detailed survey of gravel extraction. Detection ranges in excess of 365 m have been achieved for particular targets, but the normal ranges in general are 320 m for a small wreck, 230 m for a small fish shoal and 180 m for a single large fish.

The facility with which trawls in operation in midwater and over a bottom could be observed, with their headline easily descernible and delineation of considerable streaming from the otter boards, are special advantages with this instrument for the practical fisherman who can quickly determine by direct observation of fish abundance areas in which to trawl (Fig. 2). He would first check that the region is clear of rocks, wrecks and other hazards to his gear. During trawling, the depth of shoals can be monitored using elevation scanning, the net height adjusted, and finally direct observation of the catch can be made to indicate a suitable time to haul. By using elevation scanning across trawls, section can be taken along the whole of the net and the position of the fish in water column relative to the sea bed can be determined. It is also possible to measure the vertical extent and distribution of fish shoals. Fish behaviour with reference to the approaching net could also be studied with this sonar. This instrument could be fitted in a ship as small as 45 m length. Development of this equipment is complete and its applications are increasing. It appears to be a most important addition to the equipment available for fisheries research in the World.

The estimated cost of one unit of this instrument is about Rs. 20 lakhs.

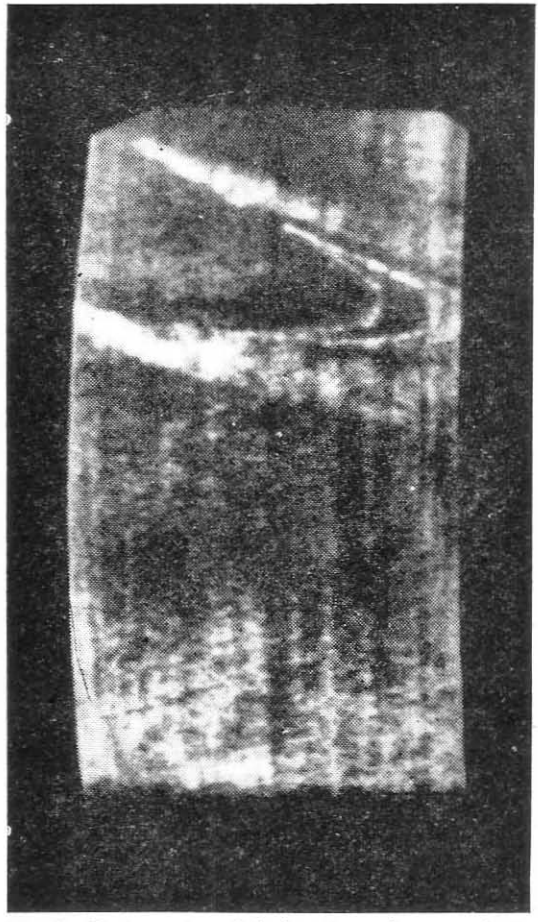

Fig. 2. Bottom trawl being towed over a bottom of sandas scanned by the Sector Scanning Sonar.

Transponding Acoustic Fish Tag

The Transponding Acoustic Fish Tag consists of a receiver and transmitter used in a transponding mode. The size of the unit is 5 cm long by 1 cm diameter and it weighs 4.0 g in sea water of salinity 35‰. A detailed description of the design, construction and assembly, performance and trials is given by Mitson and Storeton-West (1971). When the transponding principle is used, the pulse transmitted from the ship's sonar is received by the tag and used to trigger its transmitter, thus sending a return pulse to the ship. This gives an accurate range measurement between

the ship and the fish. The other measurements needed are bearing and depth; and these could be obtained with a high degree of accuracy when the ship is fitted with an electronic sector scanning sonar. It has a unique facility whereby either azimuth or elevation scanning may be selected at will, the changeover from one to the other being accomplished in 3 seconds. Thus the position of a target in the water column may be determined relative to the ship, within the accuracy of the receiving beam, which has an angular resolution of 0.33° in the scanning plane. This beam in this plane scans a sector of 30° (Fig. 3)

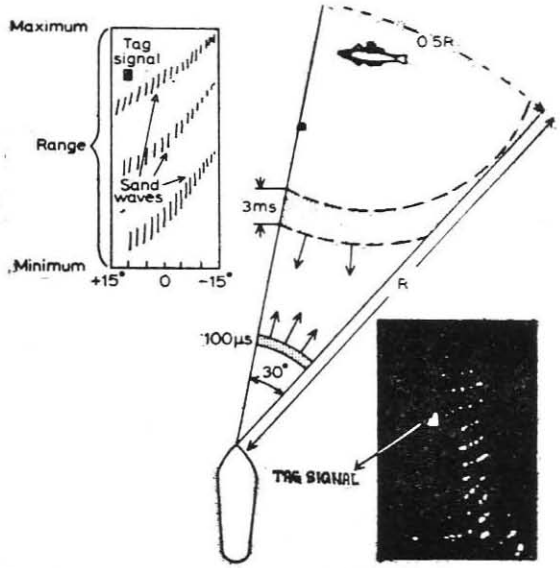

Fig. 3. Diagrammatic representation of the operation of ARL Scanner, used in conjunction with a tranponding acoustic fish tag. On the right is a photograph of the actual scanner display showing the fish tag signal against a background of sandwaves. (Figure from the report of the Director Marine Fishery Research Fisheries, Laboratory Lowestoft).

Although single fish can be detected and followed by sonar equipment without the use of acoustic tags individuals cannot be identified. The transponding acoustic tag therefore assists in the study of fish behaviour, migration, reaction to fishing gear and movements relative to bottom features. Each tag is estimated to cost about Rs. 150.00

Besides the transponding acoustic fish tag, other conventional tags are also employed in the United Kingdom (Fig. 4). Tagging and subsequent re-

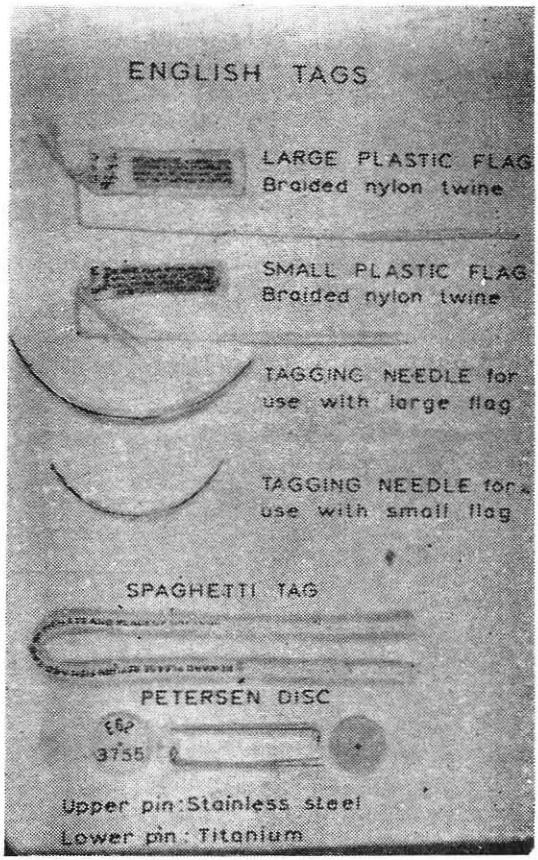

Fig. 4. Conventional fish tags.

covery of marked specimens of marine fish could reveal directly the degree of intermixture of the fish from different regions of the sea. It also provides information on the migratory behaviour of population, age, growth and mortality. Among the different types of tags used

in U.K., the 'Flag Tag' and 'Bolster Tags' used for herring and mackerel are very simple and easy to operate on board the vessel. Also the time consumed for tagging is very little and the tags are less expensiee. The above two tags could easily be tried in India on the oil sardine and on the Indian mackerel. Other special type of tags, the ' Dart Tags' meant for larger fishes like tunas (FH-69) and for smaller fishes (FT-1) as well, manufactured in the United States of America are also on the market. Cost per 1000 of the latter two varieties without legend and numbering is about $ 220.00 and $ 82.50 respectively. The modified gun (Fig. 5) used for implant-

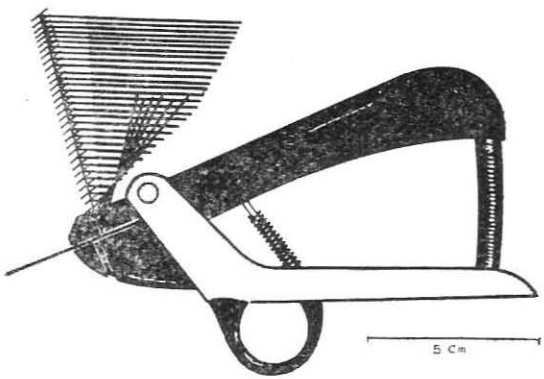

Fig. 5. Mark II, FD-67 tagging gun.

ing the tag on fish have proved to be far more efficient in tagging very small fish as well as large fish. Instructions for operation of the gun, its care and tagging procedure are provided by the manufacturing company* at the time of supply.

Multi-purpose High-speed Plankton Sampler
(Fig. 6)

The Multi-purpose High-speed Plankton Sampler has been developed at the Fisheries Laboratory, Lowestoft. Its design, operation and working characteristics have been fully described by Beverton and Tungate (1967). This is more efficient than a standard plankton net for catching the larger and more mobile plankters, particularly fish larvae. This device would sample simultaneously and in the same way the

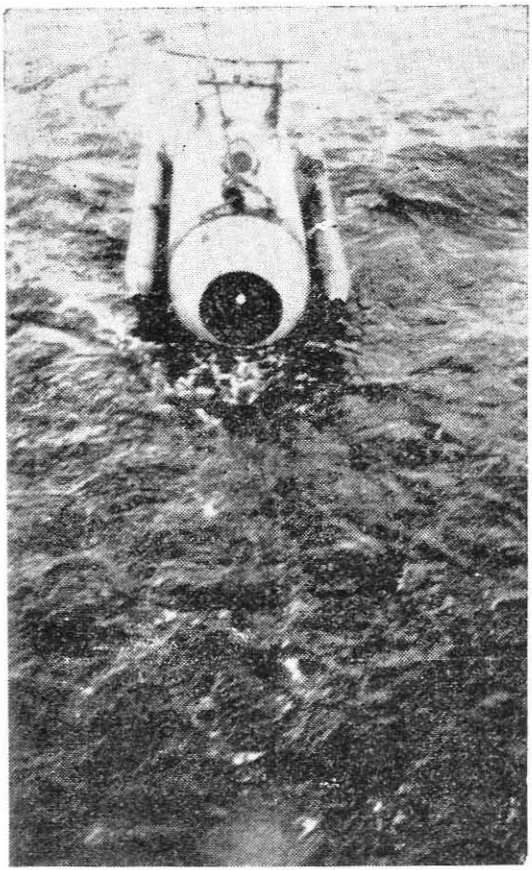

Fig. 6. High-speed Plankton Sampler in action

abundance not only of fish eggs and larvae, but also that of their planktonic competitors and predators, and in particular their food organisms. Thus the multi-purpose high-speed plankton sampler has become a useful tool mainly in the studies of the fish eggs and larvae.

The sampler is normally fished to within 1 fathom of the sea bottom from a vessel steaming at 5 knots. It is shot

* Floy Tag and Manufacturing, Inc. 4616 Union Bay PL. N.E. Seattle, Washington 98105.

and hauled at a constant warp speed, and the depth to which it fishes is controlled by adjusting the length of the towing cable. This type of haul samples each interval of depth equivalently, but the samples obtained give no information about depths at which the organisms are most abundant. In order to collect uncontaminated samples from selected depths for studying the depth distribution of pelagic fish larvae the Lowestoft multi-purpose sampler has been fitted with net-changing mechanism, the details of which have been described by Harding *et al* (1971). Here the desired net is released to the fishing position, in sequence as the sampler is hauled from one depth interval to the next. In practice, however, this sampler has normally been fished from the deepest level to the surface, changing the nets at selected levels and sampling four layers of water in succession. Diagramatic representation of the paper traces for typical hauls are shown in Fig. 7.

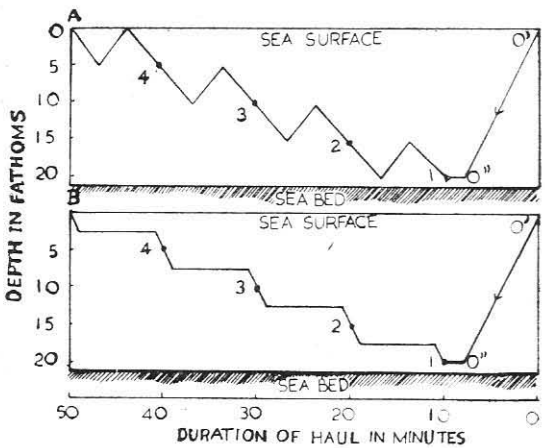

Fig. 7. Diagram of diving profiles. Initial dive 0′–0″, 0″–1 calibration haul without nets; numbers 1 to 4 indicate positions at which nets are changed. A. Vertical oblique hauls within selected levels. B. Horizontal hauls at selected levels. (Figure from Harding *et al.*, 1971).

The multi-purpose plankton sampler with the net-changing machanism would therefore sample not only the general abundance but also the vertical distribution of the plankters. Calculations of numbers of particular planktonic items per cubic meter and numbers under meter squared could be done from the basic information obtained along with the sampler resulting in the estimation of the volume of water filtered. Since variability of recruitment to the fished stock is most likely to be determined at a very early stage in the life history, probably during the egg and larval phase, studies of this nature are of immediate importance to the fisheries in general. One unit of the sampler is estimated to cost about Rs. 25 thousand.

An earlier design of the Scanning Sonar installed on P.A.S. *Gossamer* in 1964 was used in an extensive joint trial with the Ministry of Agriculture, Fisheries and Food, Fisheries Laboratory, Lowestoft, during which observations on fish detection and direct observations of shoal behaviour and observations on midwater trawls were carried. The results have been published by Voglis and Cook (1966), Cushing and Jones (1966) and Cook (1967). After subsequent minor modifications to the Sonar itself, the equipment, now known as the A.R.L. Scanning Sonar was fitted in R.V. *CLIONE* of the Lowestoft Fisheries Laboratory in 1969 in order to carry out work in fisheries research. Since then determination of the height of the individual fish to, for example, the sea bed, and a measure of the vertical extent and distribution of fish shoals has become possible (Mitson & Cook, 1971). By closely following the shoals of mackerel and other fish, their escape reaction to the approaching fishing gear

has also been observed with the help of the Sonar (Mitson & Cook, 1971). Since then, according to the Report of the Director of Fisheries Research for 1969–71 this equipment has been used for observing fishing gear, fish shoals and features on the sea bottom. Mid-water herring trawls and bottom trawls of the type used by most British deep-sea trawlers have also been observed in operation. In 1970 and 1971 the fishing shapes and dimensions of a Granton bottom trawls, a single boat pelagic trawl and purse seines were recorded by use of the ARL Scanner. By manoeuvring *CLIONE* close behind the towing trawler, trawls were seen from above, from behind and from the side at ranges upto 300 m. The details of each trawl were clearly discernible, e. g. towing warps, otter-boards, bridles, dan lenos, net and cod-end. The transponding acoustic tags have been tried on plaice and cod for tracking exercises concerned with their migration studies and the details are published by Mitson & Storeton-west (1971). More recently, according to the report of the Director of Fisheries Research (1969–71) the tags have also been used for studies of behaviour of these fishes in relation to trawls. According to Report of the Director mentioned earlier the Lowestoft multi-purpose high-speed plankton sampler is regularly employed in the offshore surveys on the known spawning grounds in the English Channel and Southern and Central North Sea to determine changes in the abundance and distribution of plaice eggs and larvae, and of their competitors and predators in the plankton community.

Of the foregoing three kinds of equipments, the first two complement each other and provide information to the practical fishermen about the quantity and kind of fish he can get at the moment of fishing, and the third one will enable the fishery scientist to advise fishermen on the amount of catch of any particular group of fish that could reasonably be expected under normal circumstances in the near future, when it makes its debut in the fishery.

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