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Instrumentation for Behaviour Studies of Marine Animals

T.K. SIVADAS, K. VIJAYABHARATHY and K. RAMAKRISHNAN
Central Institute of Fisheries Technology Cochin 682 029

Principles, salient features and applications of electronic instruments developed for behaviour studies of sedentary animals and fish in the laboratory under simulated conditions are discussed. Fish activity recorder senses the vibrations produced in water as a measure of activity of fishes kept in an experimental tank. The signals picked by a sensor kept in water are processed to indicate both qualitative and quantitative information regarding the activity. Cirri beatings are sensed by a sensor whose antenna is made to float on water above the cirri of the animal. The sensor kept on the upper shell of the animal picks up the oyster shell movements. The basic information on the responses of the animals to simulated conditions can be extrapolated to field conditions along with environmental data gathered by other means for better fishery forecasting and ecological studies.

Key words: Fouling organisms, behaviour studies, instrumentation

Fouling on ship bottom results in hull corrosion and reduced efficiency in the operation of the vessel. Studies on the fouling organisms under different environmental conditions will help in their control measures. Study of activities or behaviour of the animals under natural conditions require large infrastructure and is a tedious task. But the behaviour studies under simulated conditions are comparatively easy. These studies help predict the behaviour of the animals under natural conditions and hence will be useful for subsequent development of methods and tools.

Fish consumes more oxygen when active than when quiescent (Krough, 1916; Bowen, 1932; Clausen, 1933; Smith and Mathews, 1942; Szymaski, 1914; Spencer 1939). Spoor (1941) used a recording activity detector along with a continuous flow system for measuring oxygen consumption. Bayer *et. al.* (1982) described an instrument using six photoelectric cells and light sources kept immersed in water and a six channel recorder for measurement of speed and direction of lobster response to food. Observations and measurements from the field complement the laboratory studies to arrive at definite results. Instruments developed in Central Institute of Fisheries Technology for behaviour studies of sedentary animals and fish are described in this paper.

Fish Activity Recorder

This instrument helps to make academic studies on the behaviour and response of fishes to simulated environmental conditions in experimental tank. A schematic

diagram of the instrument is shown in Fig. 1. It has a sensor kept immersed in water in the experimental tank to sense the water disturbance caused by the activities of fish. The disturbances converted into electrical signals are processed and fed to a strip chart recorder. The analogous signals representing the rate of activity are further processed and the total magnitude is displayed digitally on a six-digit counter. The special features of the instrument are:

- The measurements can be made without causing any hindrance to the natural behaviour of the animals
- Operation can be continued for several weeks or months, and
- Programmed operation is possible.

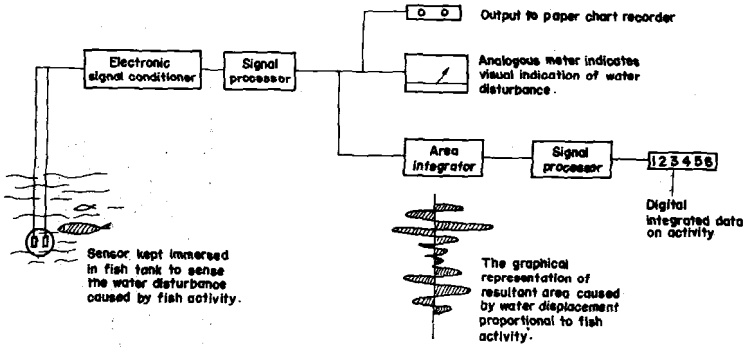

Fig. 1. Schematic diagram of the operation of fish activity recorder

Shrimp Stimulation Sensor

This senses the response of shrimp when they are stimulated with conditions such as nutrients, food etc. The sensor has been designed with suitable features for enabling attachment to fish activity recorder as an accessory. It consists of a cage in which the animal has restricted motion but with freedom to move the legs freely in response to stimulation. The movement of legs is sensed by means of a diaphragm kept near it. The signals produced from the diaphragm are compatible with fish activity recorder and hence displayed as total movement data with the integrated values in the counter representing the total resultant reaction.

Barnacle Cirri Movement Counter

The cirri movements of barnacle are related to their activity in response to environmental conditions such as availability of oxygen, food, temperature, salinity, toxic ingredients etc. The instrument estimates the number of cirri beatings produced by the barnacle kept in a test tank that can be maintained at different simulated environmental conditions.

The sensor kept at water surface senses changes in surface tension due to the water ripples formed on the surface by cirri beatings of the barnacle kept below the surface and converts them into electrical pulses. These signals after processing are counted in a six-digit counter in the display meter. Provision has been made for connecting an external recorder that gives precise qualitative information about the

nature and conditions of the animals from the recordings. The counter makes total counts of the activities during the experimental interval. The cirri beatings are counted without any mechanical contact or any disturbance to the animal unlike in conventional methods. No adjustments are needed, once the experiment is set up and operation can be programmed by means of timers.

Oyster Activity Counter

This instrument measures quantitative and qualitative shell movements of oyster under different environmental conditions simulated in the test tank. A schematic diagram of the instrument is shown in Fig. 2. A sensor in the instrument makes a feather touch contact on the shell and senses the movements. An electronic processing

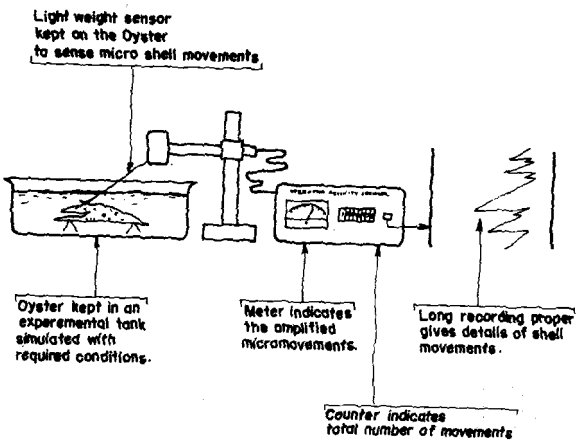

Fig. 2. Operation of oyster activity counter

unit registers these movements on a six-digit counter after processing the signals from the transducer. The total time during which the shell is open is estimated by adding the individual cases by an integrator and presented in another six digit counter, capable of taking measurements upto several months. A recorder connected to the instrument gives qualitative information regarding the nature of the shell movements. The instrument needs only an extremely light contact with the shell and is useful for studies on the behaviour and response of oysters and similar sedentary animals in relation to simulated environmental changes.

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