

ELECTRICITY GOES A FISHING!

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Introduction

Fishing with electricity is an invention of very recent origin to be commercially developed during the past two decades or so. Even though the initiative in this direction was taken by some German Scientists and the earliest experiments on the method were conducted in the early years of this century, slowly other countries also started to lay their hands on this novel endeavour and it is now applied to some extent in many of the developed countries. In India, research on this line has been initiated at the Central Institute of Fisheries Technology, Cochin, since a few years and at the Fisheries Department of some states like Orissa. This is one of the latest applications of electrical energy and because of its several advantages which will be discussed later, it appears to have a promising future in the development of the fishery industry. The aim of this article is to explain the basic principles involved in this method.

Principle

When a direct current was passed through water containing micro-organi-

sms called 'planktons', they were observed to be attracted towards the anode around which they collected. The same phenomenon was found to occur in the case of the higher orders of aquatic life also viz; fishes, which moved towards the anode under the influence of a direct current. The first reaction noticed in a fish under the above circumstances was a jerking of the body of the fish if it was already lying parallel to the flow of the current and in case the body of the fish was making an angle with the direction of flow of the current, it moved with the head facing the anode until it became parallel. This reaction required a certain amount of current which varied characteristically with the species and size of the fish. This current also produced a potential difference between the head and tail of the fish which has been termed 'body voltage'. This is also a specific property of the species and size of the fish. The second reaction which requires a slightly more body voltage is a movement of the fish towards the anode which is called 'electrotaxis' or 'galvanotaxis'. But even before the fish reaches the anode the third reaction named

'galvanonarcosis' or 'electronarcosis' takes place if the current is strong enough. Under the influence of this reaction the fish gets stupified, stunned or narcotised and lies on its sides without being capable of any voluntary movement when it is possible to collect the fish without any difficulty. When the current is cut off, the fish regains consciousness and power of movement and swims away. The interval between the withdrawal of the current and the time when the fish starts swimming is called the 'recovery time' which is found to be directly proportional to the intensity of the shock administered. Instead of direct current, if an alternating current is applied, the fish under its influence moves and orients itself in a direction in which it absorbs the least amount of electrical energy. This phenomenon is called 'oscillotaxis' and is followed by some jerks and narcosis.

Application

The intensity of the shock which the fish receives depends upon many factors like voltage of the current, size of the fish, conductivity of water etc. Bigger fishes are found to be affected by even weaker currents. If the conductivity of the water is high, a much more powerful current will be required to produce the same effect in the fish than otherwise. Continuous currents (either A/C or D/C) can be applied with success for electro-narcotising fish in fresh water fishery resources like lakes, reservoirs, rivers etc. A diesel or petrol generator of the required capacity can be used on board the fishing vessel. Field trials already conducted on these lines have yielded encouraging results.

In the case of sea fishing, the conductivity of sea water is about 500 times that

of fresh water because of the presence of salt which is an excellent electrolyte. Hence very highly powerful electric current (of voltage 500 times that required in fresh water) will be required to produce sufficient narcosis in fish. Hence while continuous current gives satisfactory performance in waters having conductivities equal to or less than that of the body of the fish, it fails miserably in waters having higher conductivities in so far as it becomes highly uneconomical and even dangerous also because electric currents of such high magnitudes as are required for the purpose may prove harmful to the operators.

Impulse Current

Under these circumstances impulse currents can be very safely employed with success. The principle involved here is to send strong electric impulses or intermittent currents between two electrodes immersed in seawater. The source of current employed in a series of accumulators or a petrol D/C generator to give input currents of the required voltage. This current is used to charge a series of condensers connected in parallel which are then made to discharge between the electrodes; but however, during this latter process, the *interse* connections of the condensers become in series. Thus if the voltage of the battery is V , all the condensers get charges at this voltage since they are in parallel connection and during discharge the voltage of the output current becomes $V \times n$ where n is the number of condensers used, since they are now in series connection. This charging and discharging of the condensers can be effected by rotating brush contacts (operated by a petrol engine) which make alternating contacts with the charging

and discharging circuits with simultaneous changing of the connection of the condensers from parallel to series. The intensity of the impulses depends upon the input voltage and number of condensers used whereas, the rate of impulses depends upon the speed with which the brush contacts are rotated. Both the intensity and impulse rates required for narcosis are characteristic of the size and species of fish. The minimum impulse rate for stunning a particular fish is called the 'threshold impulse' rate.

Advantages of Impulse Current

Impulse current has got a much greater neuro-physiological effect on living beings than direct or alternating currents and as such it has been in use for a long time in human medicine for shock therapy. Intermittent current of the required pulse rate and intensity is the most effective of all the types of electrical energy used till now for stunning fishes. When fish is subjected to a weak current which is gradually increased, the fish adjusts itself and in such cases very high currents will be required for effecting narcosis. Hence it is very important that current of the required density should be applied instantaneously so that the fish does not find time to get acclimatised to it. Pulsating current has got the least after effect on fish and is therefore particularly suited for electrical fishing.

Merits of Electrical Fishing

Since the threshold voltage required for stunning or narcotising fish is specific to species and size, selective fishing is possible in both fresh water and sea fisheries. The method can be successfully employed for fishing in areas like crevices and rocky uneven bottoms in

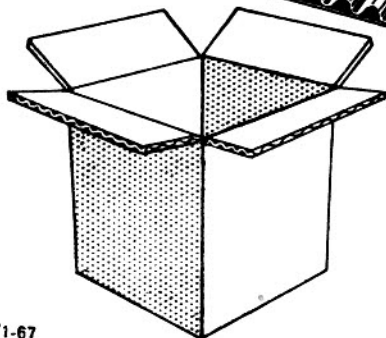
fresh water and sea which are unfishable with other gears. Fish caught by this method are stunned instantaneously by the electric impulse, preventing them from struggling so that their bodies do not undergo any physical injury. The quality of the fish is also retained to a longer period because the sudden stunning prevents accumulation of lactic acid in the muscle. Electrical method can be successfully employed for eliminating unwanted predatory fishes from ponds and reservoirs prior to stocking them with fingerlings of the required variety. This method is highly suited to catch fish from culture ponds and reservoirs for retail sales. Application of the principle in tuna line fishing not only prevents escape of hooked fish but maintains their quality because of the sudden stunning. When the hooked tuna pulls the line, it makes an electric contact which gives it the required shock. An electrode held in front of a midwater trawl can attract fish from the surrounding areas into the net. Experiments are in progress in India and abroad for designing an electric shrimp trawl which is capable of giving shocks to shrimp buried in the mud which consequently jumps out and are netted. Another possible use of electric current is as barriers or frighteners. The principle involved here is that when an electric current is applied, fish which are on the border line of the influence of the current get mild shocks due to which they get frightened and swim away. This principle is now applied to scare away fishes from being drawn into the turbines and pumps in rivers as well as for blocking off of particular areas in sea from unwanted varieties of fish. Electrical gear now finds use in whaling also. The whales can be paralysed or killed by

sending in electric impulses through the harpoons after they are hit.

Conclusion

Electrical gear opens up a new and promising line of approach for the fishing industry. Because of the several advantages of the method described above, it is likely to become more and more popular, despite the comparatively

higher capital investment required. It is worth trying the method in our country also especially in trawling. It is however, very important that the equipments be tested carefully and the fishermen given sufficient training in its operation so as to avoid dangers to human lives from faulty construction and lack of knowledge on proper handling of electrical equipments involving high voltages.



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