DEVELOPMENT OF AN ELECTRIC SHRIMP TRAWL I. REACTION OF SHRIMPS TO LOW VOLT DIRECT CURRENT

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Preliminary attempts were made to assess the effect of direct current on shrimps and to see whether the shrimp could be guided in large numbers into the fishing net by using a current of appropriate voltage without scattering them away as it happens at present. This communication is the first in the series of studies and primarily deals with laboratory equipments and experimental procedures followed.

EQUIPMENTS

The experiments were carried out initially on board a fishing vessel and the results obtained confirmed by further studies in the laboratory. Live shrimps were collected from trawl net catch and kept for acclimatisation in a plastic trough of size 75cm x 45cm. The water in the trough was changed at a ten minute interval. The experiments were conducted in another plastic trough having the same measurements. Electrodes made of 22 guage copper sheet of size 10 cm x 6 cm were connected to a battery through a volt meter, an ammeter and a reversing switch. The electrodes were suspended in the trough in such a way that the distance between them could be adjusted as desired. The reversing switch facilitated changing of the polarity of the electrodes.

PROCEDURE

One live shrimp of known size was transferred to the experimental trough. The electrodes were arranged so that the shrimp was parallel to the path of the current and facing the cathode (Position AA′ in fig 2). The reversing switch was put 'on' and the reaction of the shrimp noted The voltage applied to the electrode and the current drawn from the battery were also recorded. The distance between the electrode was then adjusted till a jumping reaction by the shrimp was noticed. Then the current was switched 'off' and the shrimp allowed to rest for some time after which the switch was operated in the reverse direction so that the current flow in the medium was also reversed by the change in the polarity of the electrodes. This operation was conducted only after effecting the necessary

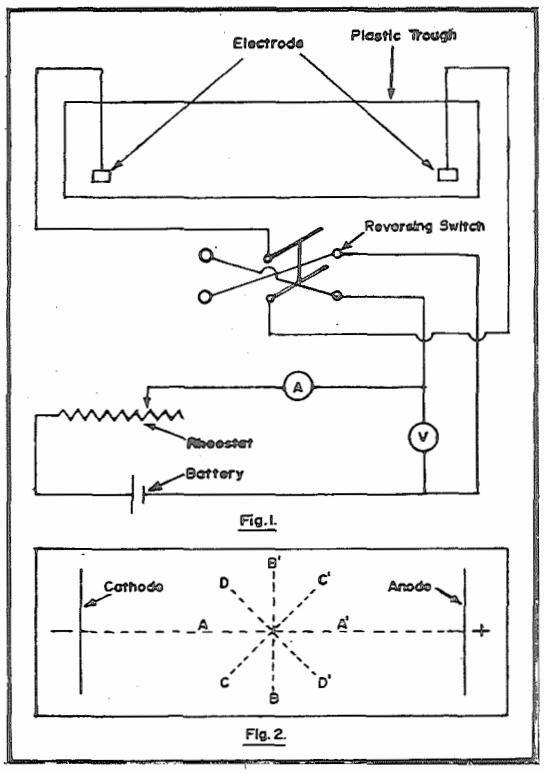

Fig. 1.

Fig. 2.

alterations in the electrodes so that the shrimp faced the electrode of the opposite polarity. The voltage was varied to produce a similar jumping reaction. The voltage, current, etc were noted The electrodes were subsequently rearranged so that the shrimp was in a position perpendicular to the path of the current (Position BB′ Fig 2). The switch was operated and the voltage adjusted to induce the jumping reaction. The electrodes were then rearranged so that the shrimp was at 60° inclination to the path of the current (Position CC′ Fig 2). The switch was operated and the voltage adjusted to induce a similar reaction in the shrimp. The operation was repeated with the shrimp in the DD′ position (Fig 2).

The above experiments were repeated with different species and sizes of shrimps. To determine the exact reactions of different shrimps such as *Penaeus indicus*, *Metapenaeus affinis* etc, the particular shrimp was transferred to the trough and the switch operated. The electrodes had fixed positions and the position of the prawn in the trough was not considered critical. The voltage was gradually increased from zero to the required value so that each specific reaction could be noted. The voltage, current and the body voltage of shrimp for causing each reaction such as jumping and stunning were recorded. This experiment was repeated for different sizes of shrimps of a normal commercial landing.

Results And Discussion

The results of the experiments are tabulated in Tables 1 & 2.

TABLE I JUMPING REACTION OF PRAWNS IN DIFFERENT POSITIONS IN BETWEEN TWO ELECTRODES

Shrimp	Body Length cm	Position	Voltage	Current amp.	Body voltage
M. dobsoni	10.1	AA′	11.5	0.9	0.6
P. indicus	18.5	BB′	11.8	0.7	0.5
M. affinis	13.5	AA′	11.0	0.7	0.4
P. indicus	20.0	AA′	11.5	0.9	0.65
M. affinis	14.0	A′A	12.0	1.5	0.6
M. affinis	15.0	A′A	8.0	0.5	0.5
M. affinis	,,	CC′	9.0	0.6	0.5
M. affinis	,,	DD′	10 0	0.65	0.5
P. indicus	22.0	A′A	4.0	0.3	0.4
P. indicus	,,	CC′	9.0	0.6	0.4
P. indicul	,,	DD′	8.0	0.5	0.4

TABLE II REACTIONS OF SHRIMPS IN ELECTRIC FIELD

Species	Length cm	Voltage	Current Amp.	Distance between electrodes cm	Body voltage	Reaction	Position of the fish
P. indicus	19.5	3.5	0.2	62.5	0.1	Slight jerk	Near the electrode
-do-	,,	8.5	0.5	,,	0.3	Moving to anode	,,
-do-	,,	9.0	0.6	,,	0.4	Narcotised	,,
-do-	16.6	11.0	1.0	,,	0.5	Jumping out	In between the electrodes
-do-	,,	12.0	1.5	,,	1.5	Narcotised	,,
-do-	18.5	11.0	0.7	,,	0.5	Jumping out	,,
-do-	,,	12.0	2.0	,,	1.6	Stunned	,,
-do-	20.0	11.5	0.9	,,	0.65	Jumping	,,
-do-	,,	11.0	0.6	,,	0.35	,,	Anywhere in the field
M. affinis	13.5	,,	0.7	,,	0 4	,,	In between the electrodes
-do-	,,	12 0	2.0	,,	1.3	Stunned	,,
-do-	14 0	,,	1.5	,,	1.1	,,	,,
M.dobsoni	10.0	,,	2.3	57.5	1.2	Narcotised	,,
-do-	8.0	,,	,,	,,	0.8	,,	,,
-do-	10.1	11.5	0 9	62.5	0 6	Jumping	Near the anode
-do-	,,	12.0	2.0	,,	1.3	Stunned	Far off from the electrode

It will be seen from Table I that in any position between the two electrodes the shrimps jump at voltages below 12. *P. indicus* in particular was noticed to jump as high as 60 cm. Larger size groups of *P. indicus* and *M. affinis* require only low voltages for causing appreciable effect on them compared to smaller ones. Further, the voltage required for causing this reaction in the shrimps, when they face the cathode is lower than that required when they face the anode, eg., *P. indicus* in the position A'A (Fig 2) requires only 4V to cause a jumping reaction whereas it requires 11.5V when it is in AA' position (Table 1). Thus the exact position of the shrimp in relation to the electrodes appears to play a vital role.

When a shrimp jumps and falls in line with the path of the current, it is stunned. But if it happens to fall in any other position, no apparent damage is caused.

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