

Tank-Experiment on the Biting Behaviour of Fish in Response to the Inedible Lure Permeated with the Extract of Food

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Abstract

1) The biting behaviour of sweep-lips in response to the inedible lure, small ball made with red cloth, permeated with the extract of small shrimp, was visually observed in the tank.

2) In case of the lure not permeated with the extract, either it was merely pecked or as soon as it was taken into the mouth of the fish, it was spewed out immediately. In that of the lure permeated with the extract, the fish took and kept it in their mouth for comparatively long time, showing swallowing behaviour. So it was considered that chemoreceptor played some important role for the fish in discriminating the edibles from the inedibles.

3) It was discussed that lure with extract of food may be of much availability in getting good catch in long-line fishing, and the reason why the catch was poor when the lure was used in tuna long-line fishing, was inferred in the discussion.

Introduction

Many kinds of lures have been developed and used in commercial fishery¹⁾. And some of them have provided fishermen with as many catch as the natural baits have. In recent years, though many kinds of lures for tuna long-line fishing have been developed²⁻⁸⁾, they have not been used in commercial fishing because of their catch which is poorer than that of the natural baits.

TESTER *et al*⁹⁾ and TESTER¹⁰⁾ reported that tuna positively responded to the extract of food. But in the fishing tests, using the lures with extract of foods in tuna long-line fishing, poor catches were got³⁻⁵⁾. Catch would be depending on the psycho-physiological condition of fish and physical and chemical nature of a lure, therefore, it may not be easy to judge the availability of extract permeated in an inedible lure from the catch data only. Therefore it becomes necessary for us to get further information both on the attracting factor of the food and on the biting behaviour of fish in response to the lure. In this paper the authors report the biting behaviour of fish in response to the inedible lure with the extract of food.

Materials and Methods

Fish used in this experiment were 30 sweep-lips *Plectorhynchus cinctus*, which were caught by small seine net in the mouth of Ichiki River of Kagoshima Prefecture in July 1971, and were kept for two weeks prior to the test in the glass-fronted wooden tank measuring 128 × 122 × 126cm, containing sea water at temperature ranging 22-23°C. Prior to, and during the test period, fish were led to take foods thrown on to the water surface, in order to elicit some

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behaviour in response to small materials slowly sinking from water surface. Before the test no food was given to fish for a day.

The lure used were 100 small balls made with red cloth, mean diameter was 6.6 ± 0.1 mm and the sinking velocity in the sea water was 11.4 ± 0.2 cm/sec.. Half of these lures were soaked in the tank water after being washed in the running tap water for a day, and were used for the test as the control lures. And the others were soaked in the extract of small shrimp for five hours, and were used in the test as the lures with extract of food.

These two kinds of lures were given alternately from a vinyl pipe suspended at the center of the tank, the lower end of the pipe being in 10cm water depth. The inside of the tank was illuminated by the sunlight penetrating from the windows of laboratory and by two 40W fluorescent lamps set on the both side-walls of the tank, the illumination in the tank being 220-140 lux.

Observation of the fish behaviour was visually carried out from the glass-front of the tank. Normally, fish distributed in the tank from the bottom to about 50cm depth. When the lures were given, fish swam ascending in response to them appearing from the lower end of a pipe. The fish-behaviour in response to the lures at this time can be divided into four types; 1) fish orientate toward a lure, 2) fish orientate and swimm toward a lure and turn on the way to the lure, 3) fish swim toward the lure and peck it, 4) fish take the lure in their mouth. In this experiment only the last two types, 3) and 4), were observed as biting behaviour. The time from the appearance of a lure out of the lower end of a pipe to pecking it by fish, and the time from the taking of a lure by fish to the spewing it by fish were measured in second with the stop watch of the observer, as they were a good measure for assessment of the vigor of the response.

As a result, the time measured distributed positively, it was transformed by using the simple logarithmic formula $T = \log(1+t)$, where t is the actual time measured.

Result

Biting behaviour of fish was elicited by 42 control-lures and 39 lures with the extract out of 50 lures used. The results were shown in **Fig. 1**, **Fig. 2** and **Table 1**. Most of these lures were pecked within a second, and there was no significant time difference between the two kinds of lures ($t = 0.012$, $df : 79$, $P \gg 0.500$). When only the control lures were thrown, fish

Table 1. Summary of the statistical analysis. The time measured was logarithmically transformed, the differences being tested.

| | | Number | Mean and Sd | | t-test |
|---|-----------------------|--------|-------------|------|--|
| Time from the appearance of lure to pecking by fish (in second) | Lure with the extract | 39 | 0.70 | 0.53 | $t = 0.012$ $df : 79$ $P \gg 0.500$ |
| | Control | 42 | 0.71 | 0.61 | |
| Time from the taking of lure by fish to the spewing of it by fish (in second) | Lure with the extract | 38 | 8.05 | 6.50 | $t = 17.870$ $df : 77$ $P \ll 0.001$ |
| | Control | 41 | 0.34 | 0.43 | |

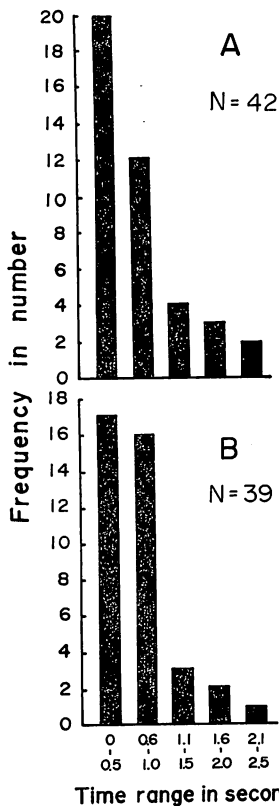


Fig. 1. Frequency-distribution of the time from the appearance of the lure to the pecking of it by fish. A, Control ; B, Lure with the extract of small shrimp.

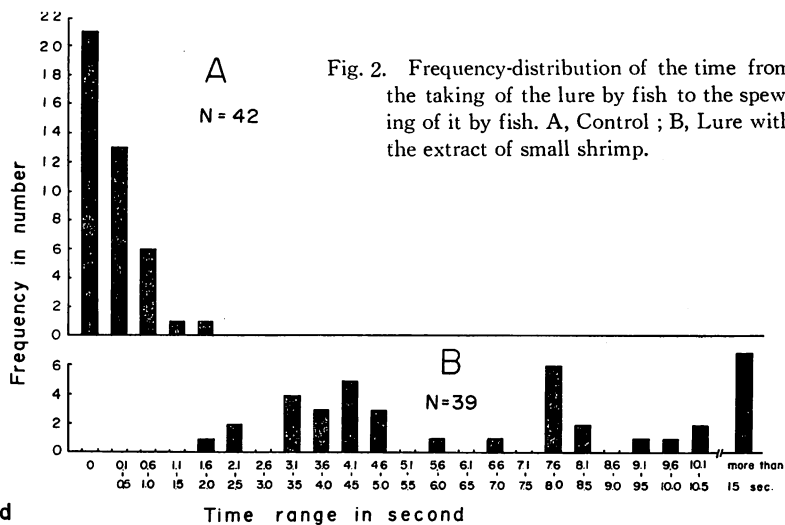


Fig. 2. Frequency-distribution of the time from the taking of the lure by fish to the spewing of it by fish. A, Control ; B, Lure with the extract of small shrimp.

seldom took them. But when two kinds of lures were thrown alternately, the half out of the 42 control lures were taken in, and all of the 39 lures with the extract were taken in (Fig. 2). The biting behaviour of fish was clearly affected by the chemical stimuli of the extract of small shrimp. Although the control lures were spewed as soon as fish took them in their mouth, the lures with the extract were kept for comparatively long time in fish's mouth ($t = 17.870$, $df : 77$, $P < 0.001$), and it appeared that fish tried to swallow them, and in one case more than one minute was passed before the spewing.

Discussion

Van WEEL¹¹⁾ studied chemoreception in both yellowfin and little tunny in the concrete tank. He found that both fish had a well-developed sense of smell or taste whereby they were attracted to certain food substances. And according to further experiments of many observers, there is no doubt that tuna are attracted to food substances. These results may suggest that it will be available to use the extract of food to the inedible lure for tuna long-line fishing. But, hitherto, very poor catch has been got by all the trials to catch tuna by inedible lure with or without the extract of food. There is a case, experienced by the authors, that a piece of pickled radish was found in the stomach of tuna, and there appeared the doubt why tuna should not be caught effectively by the inedible lures. The result of this experiment may offer an answer

to this question.

Although fish behaviour in relating to food, depends on fish species, it is certain that some chemical stimuli elicit certain feeding behaviour to some fishes¹²⁾. In the other experiment, the authors ascertained that sweep-lips could discriminate a bag with food from the bag without food in the dark. And so it is considered that chemical cues play some important role in the food-finding in sweep-lips as well as in tuna. And since sweep-lips spews inedible lure with extract of food, tuna may be assumed to spew as soon as it takes it in.

Regretfully, we have no evidence to support above assumption. This assumption must be ascertained in the further experiment. And on the other hand, the mechanism of discrimination of edibles from inedibles must be studied.

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