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## Biting Activity Both in Light and in Dark of Japanese Mackerel, *Pneumatopholus japonicus*, and Horse Mackerel, *Trachurus japonicus*

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### Abstract

To obtain a fundamental knowledge valuable in line fishing, the authors observed the biting of Japanese mackerel and horse mackerel on a still bait, using the underwater contacting tube in light and in dark. And the results are summarized as follows:

- 1) Both these two fishes could localize the still bait in dark as well as in light, biting actively on it.
- 2) Magnitude of biting activity was higher in light than in dark in horse mackerel, but it was the reverse in Japanese mackerel.
- 3) The cause of the contradictive result in Japanese mackerel was considered to lie in the method of bait-sewing to hook.
- 4) The freshness of the bait used, largely affected the biting activity in both two fishes. The magnitude of it decreased in proportion to the time elapsed, and the freshest bait evoked the most active biting.
- 5) Depending on the results obtained, it was concluded that in line fishing bait must be sewed carefully to the hook and should be exchanged as often as possible.

### Introduction

Both Japanese mackerel and horse mackerel can be caught not only by edible baits but also by lures. And it is only from dusk to dawn that their catching by lures is possible, though when the water is illuminated by the attracting lamps even in night they can be lured. Furthermore, the feeding activity of the related species, *T. symmetricus* (HUNTER, 1968) and *T. trachurus* (GIRSA, 1961) declines in a certain light intensity. These might suggest that these fishes feed by vision. On the other hand, our fishing experiences suggest the appreciable effect of the freshness of bait upon the catch efficiency, and the important role of chemical sense in bait-feeding or bait-biting in these two fishes. The knowledge on the sense in bait-biting offers us valuable information for line fishing, though not ascertained yet.

In this paper the authors report on the biting activity in light and in dark of these two fishes on the edible bait. And this study was carried out as one of the series of studies on line fishing of these two fishes.

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### Materials and Methods

The size of the tank used was 1 m × 1 m × 1 m, and the water was filled up to 70 cm depth. The water in the tank was changed by running the water flowing into the tank by 20 litre/min. to make a flow in the tank and at the same time to keep the chemical condition in the tank water constant, because fish does not localize the source of odor in the still water (KLEEREKOPER, 1967). The tank was covered to get total dark, and an incandescent lamp (100 volt, 20 watt) was set at the top of the cover, and when this lamp was lighted on, the light intensity just above the water surface was noted to be 8 lux. The facility used in this experiment was drawn schematically in Fig. 1.

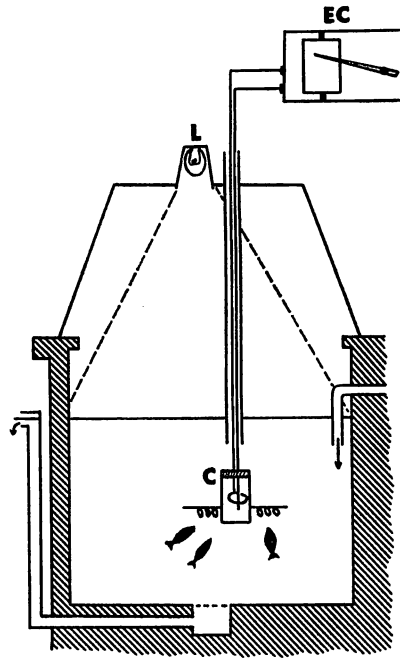


Fig. 1. Schema showing the facility and the method used in the experiment.  
C, underwater contacting tube with hooks to which baits were sewed;  
EC, electric counter.

For the recording of the biting activity, the authors used hook-typed underwater contacting tube devised by Dr. HIRATA (cf. Fig. 1 and Fig. 8 in HIRATA, 1973), which was very convenient for their use. The bait, flesh of salted anchovy, was sewed to the hooks fixed to the tube, and whenever fish bit on the bait, the biting was recorded by an electric counter.

Considering the learning effect of the fish and its appetite, we sewed various size

of bait to the hook, enabling the fish to eat only a part of the bait sewed.

A group composed of ten juvenile fish was introduced into the tank, and was acclimatized to the tank for more than ten hours previously. During the acclimatization, no food was given to the fish.

To clarify the effect of the freshness of bait used on the biting activity, three kinds of baits different in freshness were made by soaking them in the running sea water previously for 5- or 30-minute. The underwater contacting tube annexed with bait was set at 20 cm depth, and contacting-frequency caused by biting was recorded for 60-minute in dark and in light after the tube was set.

These were carried out in the pond of Research Station at Kamoike of Kagoshima University, and the water temperature in the tank during the observations was approximately constant, from 25.8 to 26.0°C.

### Results and Discussion

Fishes responded well toward the bait sewed. Magnitude of biting activity was

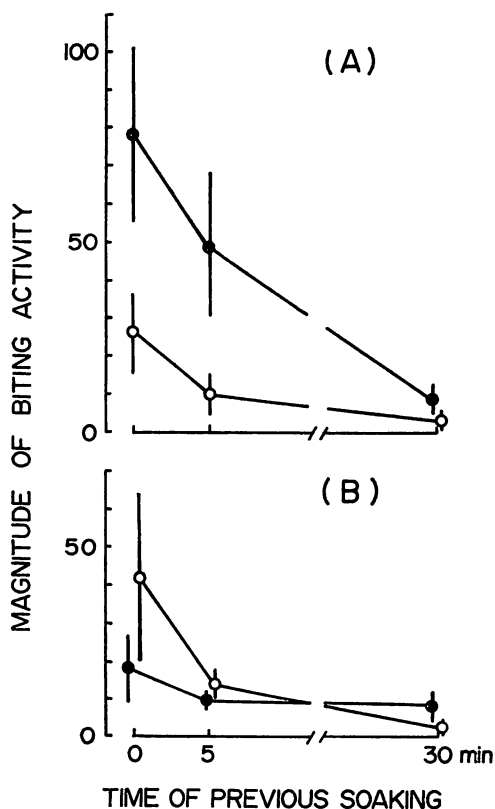


Fig. 2. Magnitude of biting activity on the underwater still bait in light (open circle) and in dark (closed circle). The vertical lines through the points represent the standard error. (A), Japanese mackerel; (B), horse mackerel.

represented by the number of contacting frequency recorded in the following figures. Average magnitude of seven recordings in each kind of baits was shown in **Fig. 2**. As the magnitude largely fluctuated in each recording, the differences among the averages were not significant statistically. But depending on an apparent tendency which can be seen in the figures, the following could be said. In both two fishes, the bait soaked previously longer evoked less biting of the fish than the fresh bait without previous treatment. And this is clearer in japanese mackerel than in the other.

Both two fishes could localized the still bait, biting on it in dark. Comparing the magnitude of biting activity in light and in dark, in horse mackerel, it was higher in light than in dark, but in japanese mackerel it was the reverse. These mean that visual image of the bait sewed affected the biting response excitatively in horse mackerel and inhibitably in japanese mackerel. This result in japanese mackerel is contradictory to the previous anticipation. In other observations, fish not responding to the bait sewed to the tube, responded well to a moving flesh of salted anchovy in light, swimming away from the contacting tube. Therefore the cause of contradictory result in japanese mackerel was considered to lie in the method of bait-sewing. Among the japanese line fishermen the method of bait-sewing has been believed to affect the response of fish, and this is why they sew a bait to a hook seemingly alive in some line fishing. Judging from the result in japanese mackerel, the fishermen's effort may be considered to be reasonable. But, as noted in the previous paper (KAWAMURA and TAMURA, 1973), the retina of japanese mackerel is more advantageous for the movement perception than the visual acuity, so fishermen need not draw attention to a fine structure of bait.

In **Fig. 3** and **Fig. 4**, the magnitude of biting activity to the fresh bait not previously treated, was compared with that which was soaked previously for 5- or 30-minute. In both fishes, the average magnitude was highest in the freshest bait; and lowest in the bait soaked for 30-minute. At the beginning, the magnitude was very high, but it decreased gradually in proportion to the time elapsed, and it approximated to the same level after more than 50-minute, except in the bait soaked for 30-minute. Both two fishes showed rare biting toward the bait soaked previously for 30-minute. This decreasing tendency in proportion to the time elapsed was sharpest in the freshest bait.

Considering the effects of learning and feeding during the recording, these figures show large effect of the freshness of bait used, on the biting activity of these fishes. And these lead to the conclusion that these two fishes can localize the fishing bait not only by vision but also by odor.

In this experiment, still bait was used. If moving or sinking bait was used, the result might be a little different, because in previous observation in dark fish failed to feed on moving bait. Thus these fishes may note the existence of moving bait by its odor, but they can not bite on it without the aid of vision. Therefore, as the conclusion, it could be said that, in line fishing, baits must be sewed carefully to the hook and baits should be exchanged as often as possible.

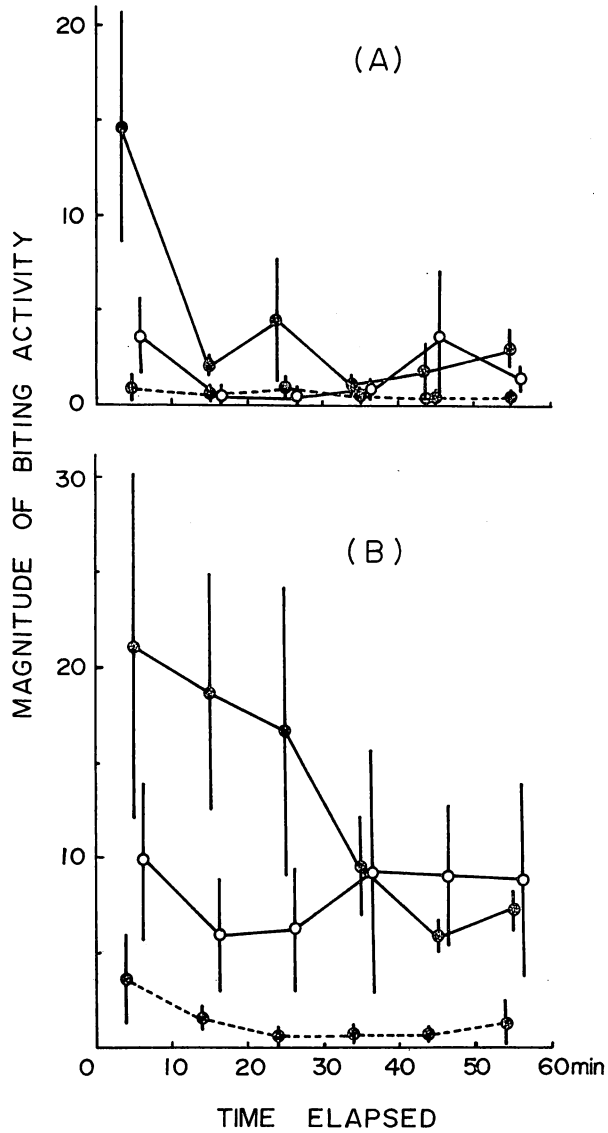


Fig. 3. Change of the magnitude of biting activity in proportion to the time elapsed in Japanese mackerel. (A), in light; (B), in dark. Closed circle and line, fresh bait without previous treatment; open circle and line, bait soaked previously in the running sea water for 5-minute; closed circle and broken line, bait soaked previously for 30-minute. The vertical lines through the points represent the standard error.

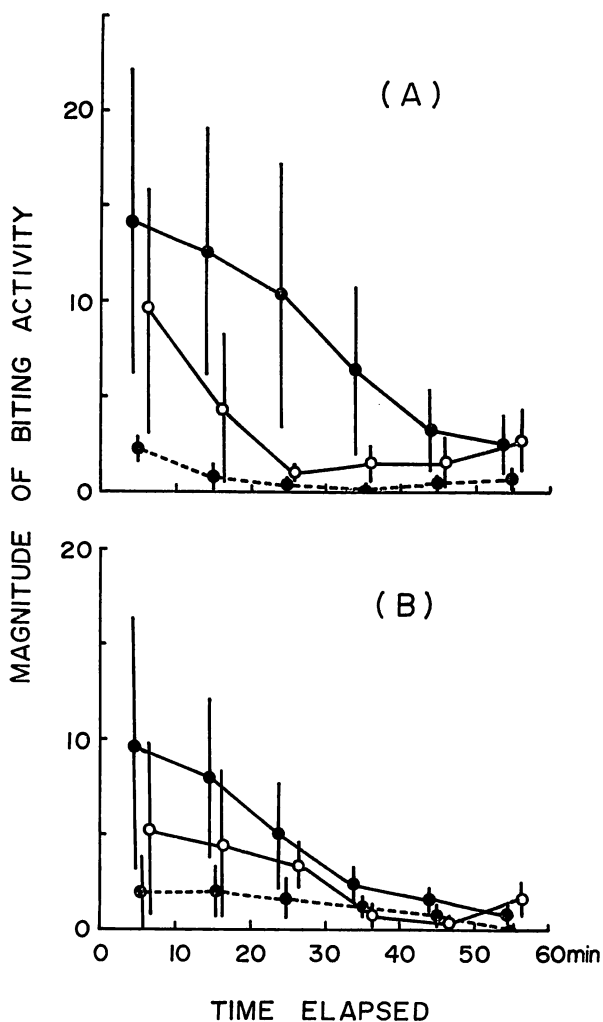


Fig. 4. Change of the magnitude of biting activity in proportion to the time elapsed in horse mackerel. Symbols are same as in Fig. 3.

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