

マグロ延縄の揚縄速力II

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著者	前田, 弘 西野, 正見 南, 四郎
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Hauling Speed of Tuna Longline—II.* Change of the Speed with Lapse of Working Time

Hiroshi MAEDA, Masami NISHINO, and Shiro MINAMI**

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It is one of the characteristics of the tuna longlining that the simple and repetitious hauling work extends over very long hours. And many of the conditions change with the lapse of time. The present report dealt, accordingly, with the change of the hauling speed with the altitude of the sun till the astronomical twilight and that with the lapse of time after it; and the results obtained were summarized as follows:

1. The difference of the average hauling speed of the sections during the astronomical twilight and at night from that in the daytime was not larger than 15%. This was far smaller than our impression during the work on board, because the results did not concern with the effort paid by the fishermen.

2. It took a little longer time to haul up the first and the last several sections than the time to do so their adjacent sections, because these sections were meandering severer than those in the other parts.

3. The hauling speed was the fastest when the altitude of the sun was not smaller than 20°.

4. The speed was slightly reduced when the altitude of the sun was smaller than 20°, and was the smallest during the astronomical twilight especially when the estimated altitude of the sun was -10° to -15°.

5. The speed at night took the similar value to that during the declining sun and civil twilight (20° to -5°), and did not show reduction with the long lapse of working time.

It is one of the characteristics of the tuna longlining that the simple and repetitious hauling work continues over very long hours. Many of the conditions change with lapse of working time for hauling. The work extends from daytime to midnight, passing through the hour of declining sun, the sunset, and twilight. The difficulty of looking over the scattering markers along meandering line increases in accordance with the change of the light in the sky. In the daytime, it is easy to catch sight of the hooked fish being pulled at boardside and easy to gaff it. But at night it is hard to catch sight of the approaching fish till being pulled into the beam of the lamp, and it needs much time and effort to secure the fish because the waves lapping boardside reflect the lamp irregularly and disturb to catch clearly sight of fish. The fishermen are getting tired, and the deck is putting disorder with the lapse of working time. Therefore, the change of the hauling speed with the lapse of time especially in relation to the change of the light in the sky and the speed after long work are interesting problems of hauling speed of tuna longline. The present report dealt with these problems.

* Contribution from the Shimonoseki University of Fisheries, No. 631

** Shimonoseki University of Fisheries, Shimonoseki, Japan (前田 弘・西野正見・南 四郎: 水産大学校)

Material and Method

The detailed descriptions of the materials used in the present series were illustrated in the first report of this series³⁾. Among many of the conditions changing with the lapse of time, the change of the light in the sky and the accumulation of fatigue of fishermen were the major factors probably having close relation to the hauling speed. The light in the sky changed during the earlier half of the hauling work; and the accumulation of fatigue may affect the speed rather during the latter half of the work. To show the change of the light in the sky, the altitude and the azimuth of the sun at the time each of the junctures passed through the line hauler were estimated graphically from the nautical almanac³⁾. The sections of mainlines were stratified into the altitude groups of the nearest five degree intervals till the -20° group (a little after the astronomical twilight), according to the altitude of the sun at the time passed the last end of the section through line hauler. And those hauled up after the astronomical twilight were stratified into the hour groups of the nearest half hour intervals, according to the time passed the last end through line hauler. And the hauling speed histograms of the sections thus classified were used in the present report.

Results

The altitude of the sun at the beginning of the hauling work was from 62° to 55° , according to the time to start the hauling work. The sunset was about 17:30 to 17:45 in the ship's time, and the astronomical twilight (the estimated altitude of the sun = -18°) lasted till about 19:00. The hauling speed histograms of the sections without catch, with a yellowfin, and with a miscellaneous trash fish by altitude groups in the daytime and during the twilight and those of the sections by hour groups after the astronomical twilight are shown in Figs. 1 and 2.

The change of the average hauling speed in accordance with the lapse of time was not so large as our impression of difficulty to work and accumulation of fatigue. But the following trends could be seen in these figures. In the first two altitude groups (the 60° and 55° groups), it took about 86.6 seconds to haul up a section without catch on the average. It took short time to haul up the sections in the 50° group to the 20° group, the average speed being about 80 seconds per section. In accordance with the decline of the sun from 20° to -20° , the hauling speed decreased especially in the -10° group and the -15° group, being a little longer than 90 seconds. The hauling speed slightly increased after the astronomical twilight, and did not decrease with the lapse of time during long hauling work at night, although it seemed to took a little longer time to haul up the sections in the last hour group (after 1:00) than those in the other hour groups.

Concerning with the change of the hauling speed of the section with a yellowfin or

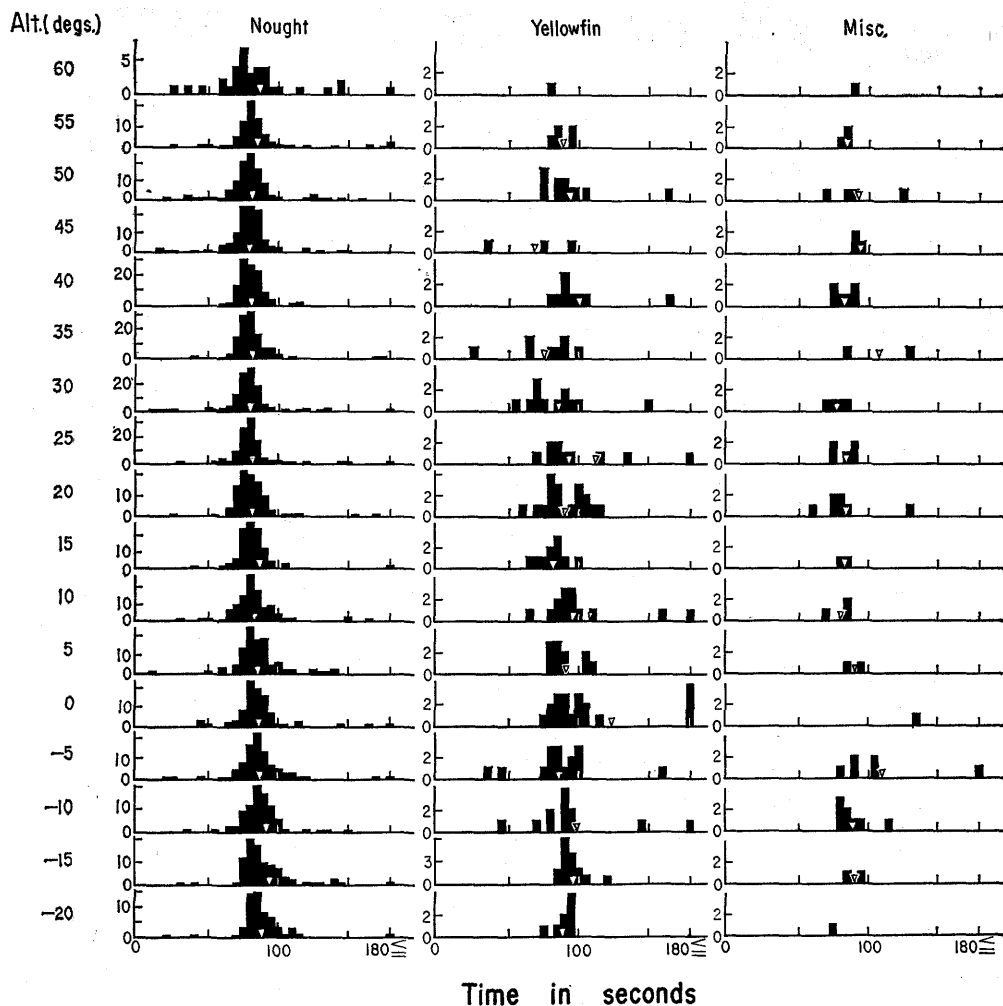


Fig. 1. Hauling speed histograms of the sections taken inboard in the daytime and during the astronomical twilight.

Note: Triangle shows the average. The sections were stratified into the groups according to the catch therein and the altitude of the sun at the time passed the last end through the line hauler.

with a miscellaneous trash fish, clear trend could not be found out, because of insufficient number of sections in respective altitude groups or hour groups and because of large variation of the hauling speed of the sections within the same groups.

Discussion

It is easy to work on deck and to manoeuvre the boat along a meandering line in the daytime, and it is hard to do so at night. In addition, the fishermen were getting tired in accordance with the lapse of time. But the present results showed that the difference

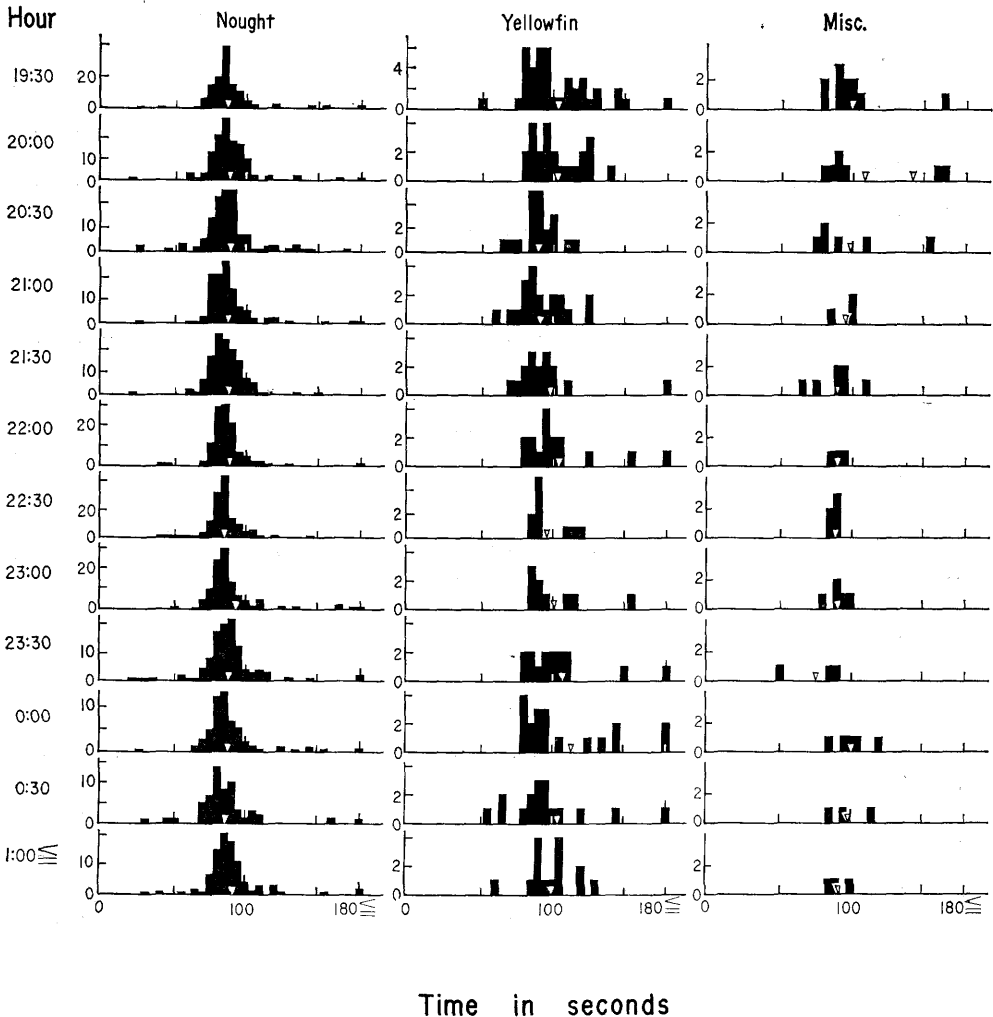


Fig. 2. Hauling speed histograms of the sections taken inboard after the astronomical twilight. Note: Triangle shows the average. The sections were stratified into the groups according to the catch therein and the time passed the last end through the line hauler.

of the hauling speed during the astronomical twilight and at night from that in the daytime was not larger than 15%. This may be because of the following reasons: The hauling speed was settled by the interaction between the pace of the line hauler and the working pace of the fishermen. Throughout the long hours of hauling, the line hauler continued to haul up the line rather at a constant speed, if possible. And the fishermen endeavored to clear away all the conditions disturbing to do so. As mentioned in the preceding report²⁾ and the report on the working time of the Danish seining¹⁾, the observed difference of the working speed did not represent the effort paid by the fishermen, but indicated the speed unable to be covered by their effort. Our impression of difficulty of

work was chiefly derived from the former reason. It is, accordingly, natural that the observed difference of the speed was far smaller than our impression. But reasonable attention should be paid to the following fact: During the time when the line was hauled up rather at a constant speed, the effort paid by the fishermen increased with the difficulty to do so. And even a slight reduction of the hauling speed meant a large increase in the difficulty and the effort.

The present result showed that it took a little longer time to haul up a section in the first two altitude groups. This may be due to such reason that usually the first and the last several sections were meandering severer than the other sections, because they lacked either the preceding or the succeeding sections preventing the adjoining sections from free meandering. The change of the hauling speed during the work from the 20° altitude group to the astronomical twilight could be explained from the change of the light in the sky. Namely, in accordance with the declining of the sun, the sight became in the direct sunbeam or the surface of the sea became glittering, especially when the altitude was smaller than 30°. In the present case, most of the sections were hauled up receiving the sun in the range from port ahead to port abeam and some of the sections were hauled up receiving the sun from starboard quarter. The disturbance of the direct sunbeam in the sight or of the glittering of sea surface by the sun in the range of altitude from 30° to 20° was made up by the manoeuvrer's effort and did not cause the reduction of the hauling speed. But those from the sun of lower than 20° was too strong to be made up. The reduction of the hauling speed was the largest when the estimated altitude of the sun was from -10° to -15°, probably because the manoeuvrer could not be adapted himself to the decreasing light in the sky. There are two ways to verify the above-mentioned possibilities. One is to compare the change of the hauling speed on the fine days with that on the cloudy days. But it was hard to do so, because all the records analyzed here were collected from the fine days. The other way is to examine the change of the hauling speed in relation to the relative direction of the sun. The results of the examination such as this will be shown in the succeeding report.

The hauling speed increased slightly, after the astronomical twilight. This may be because of the adaptation of the manoeuvrer to find easily the light buoys and of the fishermen to work under lamps on deck. The reduction of the speed could not be found out after the long hours of simple hauling work. This may be chiefly due to such a nature of hauling work that the hauling speed was led by the pace of the line hauler pulling up the line at a constant speed and may partly be due to such a work management pattern that the fishermen changed the working positions at regular intervals of the working time. But there was very little doubt that the effort of the fishermen to keep up themselves with the hauling pace of line hauler increased with the lapse of working time.

The hauling speed of the sections in the last hour group was a little slower than in

the other hour groups. This may not be due to the accumulation of fatigue but may be due to the meandering of the line as mentioned in the speed of the first two altitude groups.

The influence of the light in the sky and of the accumulation of fatigue on the hauling speed may be clearer in the speed to haul up the section with salable fish and in that with non-salable one and their difference than in the speed of the section without catch. But it was hard to find the trend of the change of the speed of the section with catch, because of insufficient catch and large variation of the speed.

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