スケソウ漁業中の以東底曳船の作業時間 VII

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Working Time of Danish Seiners During Alaska Pollack Fishery—VII. The Relation of Working Time to the Power of Main Engine*

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The variation of the working speed of the Danish seiner was large among the hauls yielding the same amount of catch from the same depth zone under the same grade of wind wave. In the present report, accordingly, the relation of working speed to the power of main engine of the boats was examined because of the following reasons: The records were collected from the 22 boats ranging 220 to 340 Hp in the main engine. It is probable that the working speed depends on the propulsive power and the pulling and hauling ability of the boats. They depend chiefly on the power of main engine. And the results obtained are summarized as follows:

1. The time expended to complete a haul and the laying time had no relation to the power of engine.
2. The sinking-pulling time decreased but the hauling-brailing time increased with the power of the engine at a rate of 1.1 min. per 100 Hp.
3. It was hard to find the relation of the length of the interval between succeeding hauls to the power.

The working speed of the Danish seiners varied depending on the amount of catch[3]. But the influence of this factor should be treated from a different point of view, because how to yield a good catch is not the condition of work but the aim of our fishery. The preceding reports[4-7] dealt with the influence of the depth of fishing ground and of the grade of wind wave on the working speed, because the boats fished pursuing after the seasonal bathymetric migration of the objective fish under various conditions of weather. The variation of the working speed was still large among the hauls yielding the same amount of catch from the same depth zone under the same grade of wind wave, despite of the fact that the depth of fishing ground and the grade of wind wave had little influence on the working speed. These facts suggested the necessity to examine the influence of some other factors.

The records were collected from the 22 Danish seiners belonging to a fleet. They differed from one another in the particulars. For example, they ranged 60 to 85 gross tons in the size and 220 to 340 Hp in the main engine. Among the particulars of the boats, accordingly, the power of main engine was chosen and the relation of working time to it was examined in the present report.

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Material and Method

The original records used in the present series of reports were a complete set of the telegrams sent several times a day throughout the season of 1964 from each of the 22 Danish seiners to the mother ship. The detailed descriptions of them were given in the first report[2] and they were not illustrated here. The times expended on respective steps of works were reckoned from these telegrams. Many of the particulars of the boats and the equipments on them were illustrated in the operation report of the fleet. Among them, the power of main engine was chosen and the relation of working time to it was examined, because of the following reasons: It is probable that the working speed depends on the propulsive power and the pulling and hauling ability of the boats. And they depend chiefly on the power of main engine.

Results

The frequency distributions of the times expended to complete a haul by boat are illustrated in Fig. 1. A large variation of the time could be seen among the hauls by the boats equipped with the same power of main engine as well as among those by the same boats. But the time did not show a clear relation to the power of main engine, despite of the fact that their power was ranging from 220 to 340 Hp.

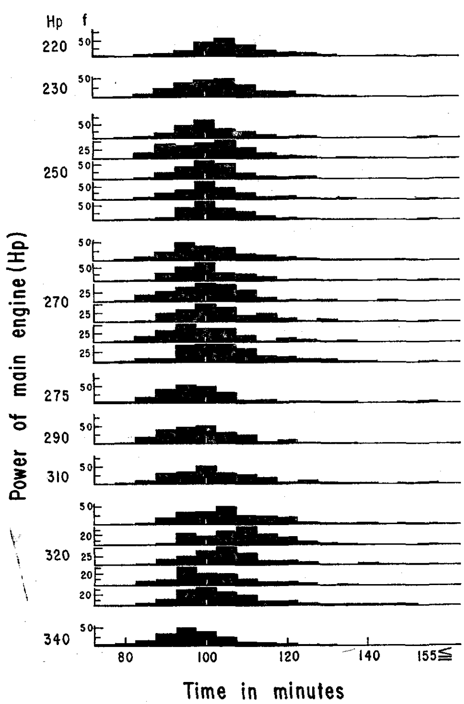

Fig. 1. Frequency distributions of the time expended to complete a haul by boat.
Note f: Frequency of the time expended to complete a haul.

The role of engine differs according to the steps of works. And it is probable that some of the steps of works have no relation to the power but other steps have a close relation to it. To find the different influence of the power on the speed of the different steps of works, the frequency distributions of the hauls in respect of the time expended on respective steps of works by boat are shown in Fig. 2. To facilitate the interpretation on this figure, the regressive relations of the times on the power are illustrated in Fig. 3. These figures showed that the time expended on respective steps of works changed in accordance with the power keeping the following relations:

$t_c = 102.21 + 0.0016\,p$	$n_1 = 1$	$n_2 = 4971$	$F_0 = 0.113$
$t_l = 19.76 + 0.0007\,p$	$n_1 = 1$	$n_2 = 4959$	$F_0 = 0.546$
$t_s = 26.36 - 0.0110\,p$	$n_1 = 1$	$n_2 = 4947$	$F_0 = 30.25^{**}$
$t_h = 56.27 + 0.0109\,p$	$n_1 = 1$	$n_2 = 4966$	$F_0 = 6.62^{**}$

(** significant at 0.01 level)

where t_c is the time expended to complete a haul in minutes; t_l the laying time; t_s the sinking-pulling time; t_h the hauling-brailing time; and p the power of main engine of the boat in horse powers. These regression lines meant that the sinking-pulling time decreased but the hauling-brailing time increased with the power of main engine of the boat, although the increase and the decrease were as slight as 1.1 min. per 100 Hp, in other words, the maximum differences among the boats in the average time due to the regressive relations were 1.3 min. In contrast with this, the maximum differences among the boats in the average time were 6 min. in the sinking-pulling time and 7 min. in the hauling-brailing

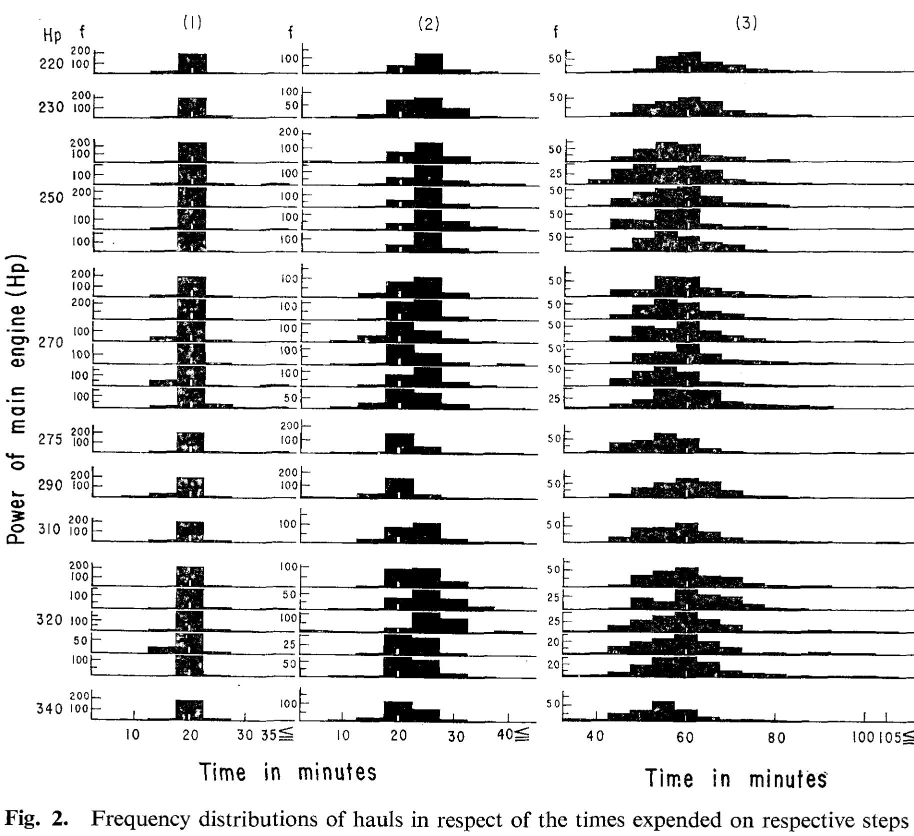

Fig. 2. Frequency distributions of hauls in respect of the times expended on respective steps of works by boat.
(1) Laying time. (2) Sinking-pulling time. (3) Hauling-brailing time.

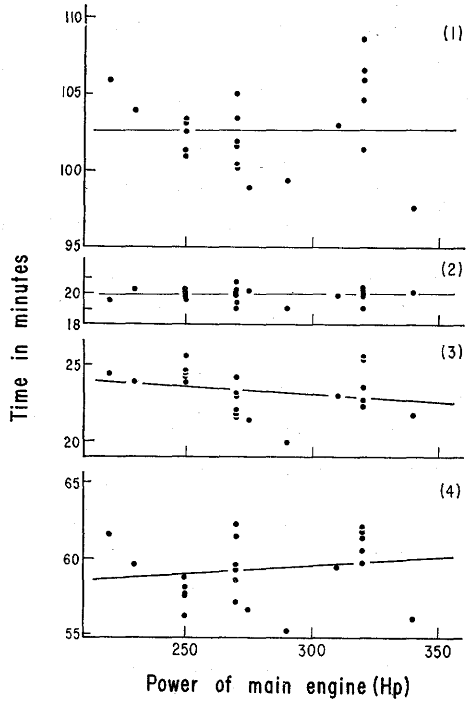

Fig. 3. Regressive relations of the working times on the power of main engine of the boats.
(1) Time expended to complete a haul. (2) Laying time. (3) Sinking-pulling time. (4) Hauling-brailing time.
Note: To simplify the figure, the frequency distributions are not shown. Filled circle shows the average time by boats.

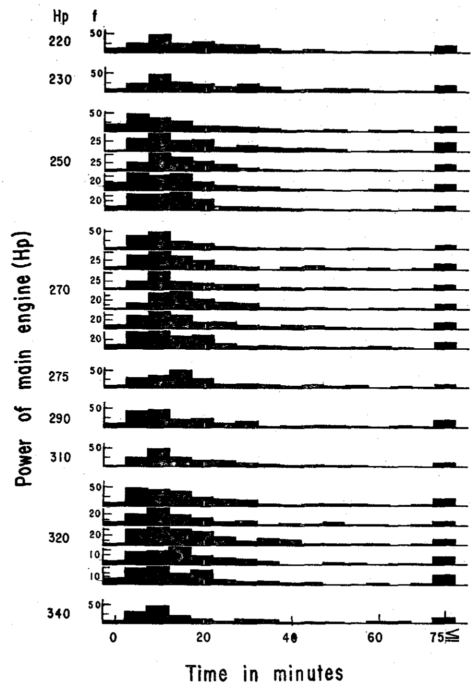

Fig. 4. Frequency distributions of the length of interval between succeeding hauls by boat.
Note f: Frequency of the length of interval.

time, as shown in Fig. 3. Namely, the differences due to the regressive relations were small when they were compared with the differences of the boats in the average time.

The frequency distributions of the length of interval between succeeding hauls by boat are shown in Fig. 4. The distributions showed tailing of the frequencies in the direction of long interval. But no relation could be found between the length of the interval and the power of main engine.

Discussion

The time expended to complete a haul showed large variation. The records examined here were collected from the 22 boats ranging 220 to 340 Hp in the main engine. But it was hard to find a clear relation between the time and the power. This result coincided with such a finding of the preceding series of the reports[1,8] that the number of daily hauls did not differ in accordance with the power of main engine.

The time expended to complete a haul consisted of the laying time, the sinking-pulling time, and the hauling-brailing time. The laying time showed no relation to the power. During this step of work, the warp and the net were paid out from the boat sailing at a considerable speed. The warp was not long. But the boat had to reduce her speed four times a laying: twice for hard turnings, once for shooting the net, and once for picking up the buoy. Accordingly, the distances between the points to reduce the speed were not long. It took about 20 min. to lay a warp and net. These facts suggested that the laying time depended not on the sailing speed with full of power but on the speed of smooth handling of warp and net.

The sinking-pulling time decreased with the power of main engine, although this was very slight. The time expended to wait the net and warp sinking may have no relation to the power of the boat. The difference may, accordingly, be in the pulling step. The pulling time relates to the pulling power and the length and load of warp. These boats used the same length of warp. The load concerns with the resistance due to the catch and drift of the boat, etc. The influence of these factors will be examined in the succeding reports. But the maximum difference in the sinking-pulling time due to regressive relation was only as small as 1.3 min., whereas that among the boats in the average time was 6 min. The Danish seiner works usually on deep grounds. But, in the present case, the ground was legally restricted to shallow waters (not deeper than 150 m). These meant that the boats worked with sufficient surplus of pulling power. As the consequence, it is natural that the sinking-pulling time decreased slightly with the power of main engine of the boat.

The hauling-brailing time increased with the power, although the maximum difference due to the regressive relation was only as small as 1.3 min. whereas that among the boats in the average time was 7 min. This may be due to the predominant influence of catch and the sufficient surplus of power. Namely, the time expended on this step of work increased with the amount of catch[3]. The previous series of reports[1,8] showed that the daily catch increased with the power of the boat. These facts make arise the question as to whether the time expended on this step of work increased or decreased with the power of the boat after elimination of the influence of the different amount of catch relating to the power of the boat. The other possibility to make it difficult to find a clear relation to the power may be due to the fact that the boats fished in far shallower grounds than those they used to fish. In deep grounds, the load to haul up the net may be large, and the hauling speed may depend on the power of the boat. But, in shallow grounds, the load may be not large, and the power can not be one of the leading factors affecting the hauling speed. These possibilities will be examined in the succeeding reports.

It is natural that it was hard to find the relation of the length of interval between succeeding hauls to the various particulars of the boats, because none of the parts of the gear were soaked in water during the interval and the boats could engage freely in various types of works.

All the above-mentioned discussions were summarized, and it may be said that the influence of the power of main engine of the boats on the working time was very small, probably because the boats fished in far shallower grounds than those they used to fish. But the present results do never deny even such a possibility that the power of the boat has a relation to the working speed under heavy conditions—such as under rough sea, when they yielded very good catch, on very deep grounds, etc.

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