Working Time of Danish Seiners during Alaska Pollack Fishery—V.*
Relation of working time to wind wave

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The oceanographic and meteorological conditions have very profound influence on the fishery in many of the view points. And the relation of them to catch had been discussed in many of the reports. Their influence on fishery could be classified into through the following three major ways: the behavior pattern of the objective fish, the shape and efficiency of the gear in water, and the working pace of boat and fishermen. Among many of the factors, the wind wave was chosen, and its influence through the last way was examined in the present report. Even when the discussion is restricted to its influence on the time expended on fishing work, the influence is complicated and differs greatly according to the fishing method and to the steps of works within the same method. The present report shows the difference of the influence of wind wave on the working time according to the steps of works of Danish seiner.

Material and Method

The detailed descriptions of the material of the present series of reports were illustrated in the first report.1) They were not shown here again. The wind wave was recorded in the grade settled by Japanese Meteorological Agency. This is the standard most commonly used by Japanese fleets. It is difficult to measure the height of wave without special device. But the height of wind wave has a close relation to the aspect of sea surface. The standard table has the description of how to determine the grade of wind wave from the aspect of sea surface. The grade was determined basing on this table. Respective grades correspond to the following range of wave height: grade 1 = 0 to 0.5 m, grade 2 = 0.5 to 1 m, grade 3 = 1 to 2 m, grade 4 = 2 to 3 m, grade 5 = 3 to 4 m, grade 6 = 4 to 6 m, grade 7 = 6 to 9 m, grade 8 = 9 to 14 m, and grade 9 < 14 m. The boats consisting of the fleet were 60 to 85 tons large with Diesel engine of 220 to 340 H.P.

Results

The grade 7 was the fishable limit. During long season, some of the days were in the grades 8 and 9, but the boats could not fish on these days. Figure 1 shows the frequency distributions of the hauls in respect of the time to complete a haul under respective

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In general, the time increased with grade of wind wave. But the relation of the time to the grade was not simple. It took longer time to complete a haul in the wave of the grade 1 than to do so in the grade 2. And the increase of the wind wave from the grade 6 to the grade 7 caused rather large retardation of work. The average retardation of the work to complete a haul in the grade 7 from in the grade 2 was 13.4 min. This corresponded to 13% of the working time in the grade 2.

The influence of wind wave differed according to the step of work. This is shown in Fig. 2. Namely, the laying time was very small in the variation, but increased grades of wind wave.
with the grade of wind wave. A little sharp increase could be seen from the grade 6 to the grade 7. The average retardation of the laying work in the wave of the grade 7 from in the grade 1 was 1.4 min., i.e. 7% of the time expended on this step. The sinking-pulling time was also retarded with the grade of wind wave, but this was slight. Namely, the difference of the average time in the grade 7 from that in the grade 1 was about 45 seconds, i.e. 3%. The largest retardation could be seen in the hauling-brailing step. The time expended on this step of work showed the similar trends to the time expended to complete a haul, in respects of the distribution type and the change with grade of wind wave. The maximum difference of the average times among the grades was 11 min. This corresponded to about 20% of the average time in the grade 2.

The frequency distributions of the hauls in respect of the length of the interval between succeeding hauls under respective grades of wind wave are shown in Fig. 3. This figure shows the following trends: In general, the interval became longer with the grade of wind wave. But it took longer time to start the next laying in the grade 1 than in the grade 2. The maximum difference of the grades in respect of the average length of the intervals, was 5.3 min. This corresponded to 33% of the average length in the grade 2. A clear influence of the wind wave could be seen in the rate of the intervals longer than 80 min. The long intervals were 1 to 5% in the grades 1 to 3; they were about 10% in the grades 4 to 6; and they increased abruptly till 20% in the grade 7.

Discussion

In general, respective steps of works were retarded with the grade of wind wave; but the trend from the grade 1 to the grade 2 was different from the general one, in the time to complete a haul, in the hauling-brailing time, and in the length of the interval.
between succeeding hauls. This was due to the following reasons: These times increased with catch, and the boats yielded better catch in the grade 1 than in the grade 2. The relation of these times to the wind wave after the elimination of the influence of the different amount of catch will be shown in the succeeding report. The laying time and the sinking-pulling time had no relation to the amount of catch, and the difference of the trend between the grade 1 and the grade 2 from the general trend could not be seen in these times. The grade 7 was the fishable limit. Really the fishing work in the grade 7, just before it became impossible to continue the work, was very heavy. And in many of the steps of works, somewhat large retardation of work could be seen between the grade 6 and the grade 7. But this was not so severe as being impressed from the difficulty to work on deck and to maneuver the boat. A severe influence of the wind wave in the grade 7 could be seen in the decrease of the number of hauls per day rather than in the retardation. But this was not shown in the present report.

The influence of the wind wave differed according to the steps of works. The laying time increased with the grade of wind wave. The maximum difference among the average times of the grades was 1.4 min., i.e. 7% of the time expended on this step of work. This seemed to be small, when compared with the impression of work on deck. This small increase was due to the following reasons: To lay the net and warp, the boat turned her course sharply twice a laying and had to return exactly to the initial point for picking up the small buoy connected with the initial end of the warp. The warp length was limited, i.e. the form of the laying course was not changeable according to the condition. Accordingly, very fine maneuvering of the boat was needed during the laying work. The boats were 60 to 85 tons. They were low freeboard and constructed to have very high seaworthiness. But it is natural that high wind wave disturbed the fine maneuvering of the boat and smooth and quick work of the fishermen on deck. The laying work was progressed chiefly at the working pace of the boat. And the fishermen assisted the smooth paying of the warp, shot the net, and picked up the small buoy once a haul. The fishermen paid much effort to keep up themselves with the progress of the work. This made the retardation as small as possible. And the value of 7% may be the retardation not covered by their effort and that due to the difficulty to fine maneuvering of the boat.

The maximum difference among the grades in the average time expended on the sinking-pulling step was negligibly small, being 45 seconds. This was due to the following reasons: During the step to wait the sinking down of the warp and the net, the boat and fishermen had no work; but the boat was drifted to leeward. After the net and warp being settled, the boat pulled her warp to leeward, receiving the wind wave from her stern. This work was progressed at the working pace of the boat. The influence may chiefly be through the difference in the pulling speed of the boat and partly through the psychological condition of the skipper. The boat was buffeted by wind wave, but the leeway
assisted the pulling. Accordingly, it is natural that the wind wave had scarcely any influence on the time expended on this step.

The hauling-brailing step was different from the above-mentioned steps. The time expended on this step increased with catch. In the present examination, the influence of the different amount of catch was not eliminated from the results, but was treated as a part of the influence of the wind wave. The hauling-brailing work showed a clear retardation with the grade of wind wave. The maximum difference among the grades in the average time expended on this step corresponded to as large as 20% of the average time in the grade 2. This meant that this step was the least resistive against the wind wave. This was due to the following reasons: The winding work of the warp was progressed at the pace of the winch driven by the main engine; and the rough sea did not reduce the speed so large as being impressed from the difficulty to work on deck. But the last step of hauling work and the brailing work were conducted at the working pace of the fishermen. And large net was in surface near the boat. Accordingly, it is natural that the wind wave disturbed the smooth and quick work of the fishermen and reduced the speed of these works.

The interval between succeeding hauls was elongated with the grade of wind wave. This was due to the following reasons: During the interval, the gear was not soaked in water. The elongation was due to the difficulty to maneuver the boat or to work on deck. The rate of long intervals increased with the grade of wind wave; but those in the grades 1 to 6 were in the range of the rate of one interval per two days. If the boats transhiped their catch every other days, the rate of long intervals reached at this value. The influence of rough sea in the grade 7 could be seen in the increase of the long intervals rather than elongation of the working time and short intervals. This was the grade of fishable limit. During the season, some of the days were in the grades 8 and 9, but the boats could not fish on these days. On some of the days in the grade 7, the boats repeated few hauls in the morning, but they had to wait the recovery of the sea condition over long hours, and they reopened their work at evening. The long intervals in the grade 7 were chiefly those waiting the recovery of the sea conditions. The influence of the wind wave in the grade 7 was far severer than that impressed from the elongation of the short intervals and the increase in the rate of long ones. On some of the days, the boats repeated few hauls in the morning and waited the recovery, but they could not reopen the work. On some other days, they waited the recovery and could start the fishing work in the evening and conducted few hauls. The time expended to wait the recovery after the last haul or before the first one was not included in the long intervals. And as the consequence, all the intervals on these days were counted to be the short ones. If they were counted, the rate of long intervals in the grade 7 increased very much.

From these trends, it may be concluded as follows: The wind wave is the phenom-
enon in the surface layer; and its influence may be through the maneuverability of the boat floating on the surface and through the difficulty to handle the gear in the surface layer. The fishing methods handling gear in the surface layer are less resistive against the wind wave than those handling gear in the bottom layer. In this respect, the Danish seine is one of the most resistive methods. But this method can not be free from the influence of the wind wave, because large net is hauled up in some of the steps of works. The working pace of the fishermen was less resistive against the wind wave than that of the boat and equipment. The step handling the net in surface layer was less resistive than the other steps. Some of the steps were conducted chiefly with the boat and equipment, while others were chiefly at the working pace of the fishermen. During some of the steps of works the net was in the bottom layer; while in the other steps the net was hauled up to the surface layer. The fishing work consists of the combination of many of the steps of works of different nature. The influence differed according to the difference of the steps in these respects. Namely, the hauling-brailing step was the least resistive, because the net in surface layer was handled at the working pace of the fishermen. And the maximum retardation among the grades of wind wave reached as large as 20% on the average. The laying time succeeded to this (7%), because this step of work was conducted at the working pace of the boat in surface layer with assistance of human hands. But the sinking-pulling step was the most resistive and received scarcely any influence (a retardation of only as small as 45 seconds or 3%), because the net and warp were in the bottom layer and the work progressed at the working pace of the boat. The hauling-brailing step, which was the least resistive, occupied as large as 57% of the time expended to complete a haul. As the consequence, the largest difference of the average time to complete a haul among the grades of wind wave reached as large as 13% of the working time, i.e. one haul a day. The elongation of the interval between succeeding hauls may be due to the difficulty to maneuver the boat finely. The abrupt increase in the rate of the long intervals at the grade 7 was chiefly due to such reason that they differed basically from the intervals in the other grades of wind wave and the boats could not work and had to wait the recovery of weather.

Summary

Among many of the oceanographic and meteorological factors, the wind wave was chosen; and the difference of its influence on the working time of the Danish seiners according to the steps of works, was examined. The results obtained are summarized as follows:

1. The hauling-brailing step was the least resistive against the wind wave. And the maximum difference of the average times among the grades reached as large as 20% of the time expended on this step, because the net in surface layer was handled at the
working pace of the fishermen.

2. The laying step succeeded to this, the retardation being 7%, because this step of work progressed at the working pace of the boat.

3. The sinking-pulling step was the most resistive and received scarcely any influence (45 seconds or 3%).

4. The fishable limit of wind wave was the grade 7; and the influence of wind wave was far larger than that impressed from the retardation of the work and the elongation of the intervals, because much hours were expended to wait the recovery of the sea condition on the days of the grade 7 but they were not counted in the intervals.

References