Working Time of Danish Seiners during Alaska Pollack Fishery—IX.*

The Relation of Working time to the Power of the Boats after Elimination of the Influence of Different Amount of Catch Relating to the Power

By

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The time required for completing a haul (t_c) by the Danish seiner consists of the laying time (t_l), the sinking-pulling time (t_s), and the hauling-brailing time (t_h). The preceding report[8] showed that the sinking-pulling time decreased while the hauling-brailing time increased in accordance with the power of the boats both at a rate of 1.1 min. per 100 Hp. But the time required for completing a haul had no relation to the power, because the decrease of the sinking-pulling time and the increase of the hauling-brailing time offset each other.

The variation of the laying time was very small. The sinking-pulling time had no relation to the catch[3], and it is less probable that its relation to the power is affected by the catch. But the following facts made it necessary to sweep up the uncertainty in the relation of either the hauling-brailing time or the time required for completing a haul to the power due to the different amount of catch relating to the power: The preceding series of the reports[1] showed that the daily catch increased in accordance with the power of the boats, but the number of daily hauls conducted had no relation to the power. The preceding report of this series[3] found out that the hauling-brailing time, consequently the time for completing a haul, increased in accordance with the catch at a rate of 3 min. per ton of catch. The catch varied from 0 to 21 tons a haul, and the power of the boat ranged from 220 to 340 Hp. Thus, the amount of catch was far more influential on these times than the power, and it is highly probable that a slight difference of catch relating to the power modifies completely the relation of these times to the power.

As the first approach to the examination of the relation of these times to the power after elimination of the influence of the different amount of catch relating to the power, the linear regression equations of these times on the power observable among the hauls yielding the same amount of catch were estimated, and the regression coefficients of the

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different catch classes were compared with one another. Then, as the second approach, the linear regression equations of these times on the catch observable among the hauls conducted by the boats with the engine of the same power were estimated, and their regression coefficients were compared with one another. And the results of these examinations are shown in the present report.

Material and Method

The material used in the present series of reports[2)-9)] was a complete set of the routine telegrams sent from each of the 22 Danish seiners to the factory ship several times a day throughout the season of 1964. The detailed descriptions of it were shown in the first report of this series[2)]. The telegrams of each of the hauls comprized the time at the start of laying the net, that at the finish of this step of work, that at the start of hauling up the net, and that at the finish of the brailing work. The season extending over from April 18 to Sept. 20 was stratified into the 16 strata of the 10-day intervals according to the calender days. Three days each were chosen randomly from each of the strata, and the telegrams of each of the hauls conducted on these days were used in the present report, after exclusion of those for the exploratory fishing and accidental haulings. From these telegrams, the intervals between the start of the hauling work and the finish of the brailing work and those between the start of the laying work and the finish of the brailing work were timed. And they were used, after aggregation of them into the nearest five-minute intervals because the accuracy of the time measuring was taken into consideration. The hauling-brailing time (abbreviated to t_h) denotes hereafter the former interval, and the time required for completing a haul (abbreviated to t_c) the latter. The catch was measured in tons, ranging from 0 to 21 tons a haul. But the records of the hauls yielding a catch of over 14 tons were excluded from the present examinations, because the sample size of them was not sufficiently large to examine the regressive relation after stratification into the catch classes. And in the former half of the present report, the records were stratified into the catch classes of one ton interval, and the regressive relations of the times on the power of the boats observable among the hauls of respective catch classes were examined. Among the 22 Danish seiners supplying the material fish to the factory ship, the six were equipped with the diesel engine of 270 Hp, the five with 250 Hp, the same number of the boats with 320 Hp, and each one of the boats with 220, 230, 275, 290, 310, or 340 Hp. In the latter half of the present report, the regressive relations of the times on the catch observable among the hauls conducted by the boats with the engine of the same power were examined.

As the present report dealt with the regressive relations of either t_h or t_c on the catch (x tons) or on the power of the boats (p in Hp) after stratification of the records according to the factor of the rest, the constants and the coefficients of the regression equations were for convenience of representation expressed as follows:

a_{ihx} .... those of the regression equation on the power

b_{ihp} .... those of the regression equation on the catch

The first suffix, i: 0.....constant 1.....coefficient

The second suffix: h.....hauling-brailing time

c.....the time required for completing a haul

The third suffix: for a, the catch class (in tons)

for b, the power group (in 10 Hp)

The suffix left intact denotes either the constant or the coefficient of the equation for indefinite strata.

Results

The records were stratified according to the catch, and the linear regression equations of either t_h or t_c on p were estimated (Table 1), for the purpose of examining the influence of the power of the boat on t_h or t_c after elimination of the influence of the different amount of catch relating to the power. The estimated regression line of t_h on p and the frequency distributions of t_h of the hauls yielding a catch of three tons by the boats of respective powers are shown in Fig. 1, and those of t_c are in Fig. 2. And Figs. 3 and 4 are for the purpose of assisting the understanding of the general feature of the change of either t_h or t_c in accordance with both the power of the boats and the catch. These table and figures revealed the following facts: The coefficient, a_{1hx}, was significantly negative in three of the catch classes, insignificantly negative in the seven catch classes, and insignificantly positive in the four classes of the rest. The coefficient, a_{1cx}, was significantly negative in the five catch classes, insignificantly negative in the six classes, and insignificantly positive in the three classes of the rest. Namely, in general,

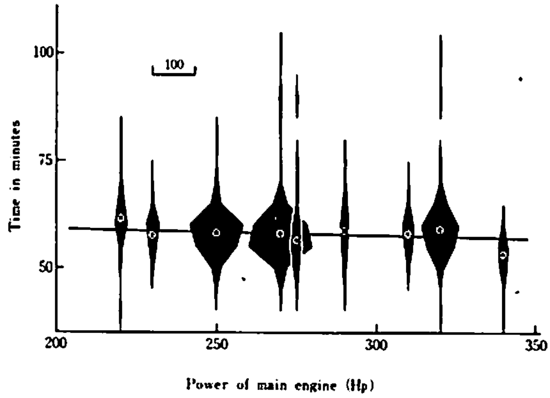

Fig. 1. The estimated regression line of the hauling-brailing time on the power of the boat and the frequency distribution of the hauls (For the hauls yielding a catch of 3 tons).
Note: scale.....for the frequency distribution
solid circle.....average of the hauling-brailing time of the hauls conducted by the boats with the engine of the same power

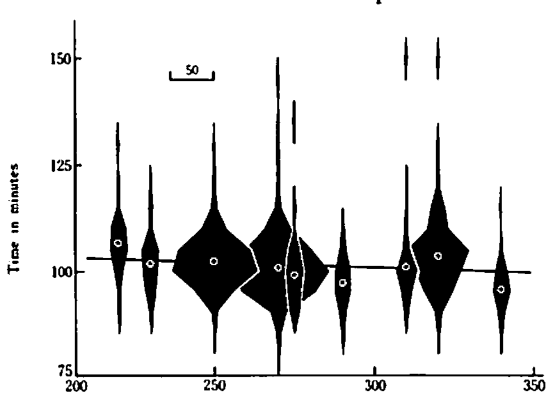

Fig. 2. The estimated regression line of the time required for completing a haul on the power of the boat and the frequency distribution of the hauls (For the hauls yielding a catch of 3 tons).

Table 1. The linear regression equations of the working time on the power (p in Hp) of the boats, estimated from the records of the hauls yielding the same amount of catch (x in tons).

a) The regression equations of the hauling-brailing time (t_h in min.)

$t_h = a_{0hx} + a_{1hx}\, p$

x	a_{0hx}	a_{1hx}	F_{hx}	n_2
0	31.716	0.063	1.557	32
1	54.871	−0.019	10.565**	663
2	56.612	−0.011	3.707	1040
3	61.480	−0.012	5.593*	1160
4	60.784	−0.0003	0.002	736
5	63.798	0.002	0.028	501
6	73.560	−0.024	4.017*	259
7	71.829	−0.003	0.051	219
8	83.682	−0.039	3.867	114
9	83.817	−0.037	0.477	38
10	77.412	0.004	0.018	108
11	81.790	−0.012	0.065	18
12	75.105	0.015	0.085	21
13	92.570	−0.024	0.252	19

b) The regression equations of the time required for completing a haul (t_c in min.)

$t_c = a_{0cx} + a_{1cx}\, p$

x	a_{0cx}	a_{1cx}	F_{cx}	n_2
0	66.267	0.092	2.032	31
1	99.760	−0.025	10.184**	664
2	103.913	−0.025	12.458**	1039
3	107.430	−0.021	9.862**	1164
4	106.904	−0.012	1.665	745
5	110.810	−0.011	0.855	501
6	117.339	−0.029	3.523	261
7	114.269	0.001	0.003	218
8	131.027	−0.051	4.279*	114
9	154.253	−0.136	7.291*	38
10	114.025	0.032	1.019	106
11	139.484	−0.069	1.727	18
12	129.384	−0.028	0.240	21
13	136.122	−0.017	0.086	21

Note: df ..... $n_1 = 1$, n_2 = the value shown in the table
*significant at 0.05 level
**significant at 0.01 level

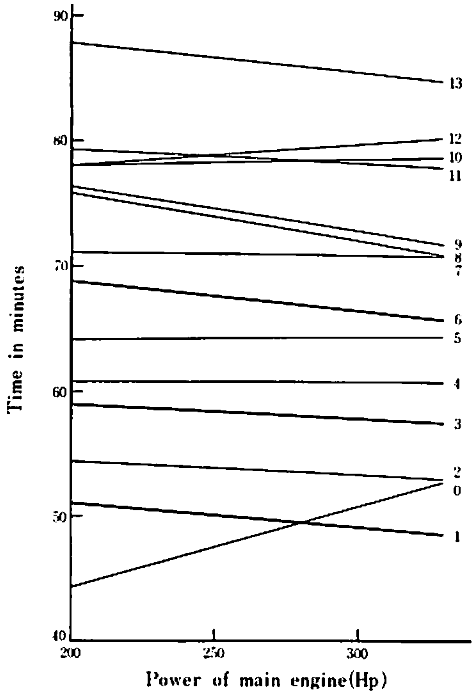

Fig. 3. The change of the t_h-p relation in accordance with the catch.
Note: The numeral attached to the line indicates the catch (in tons).

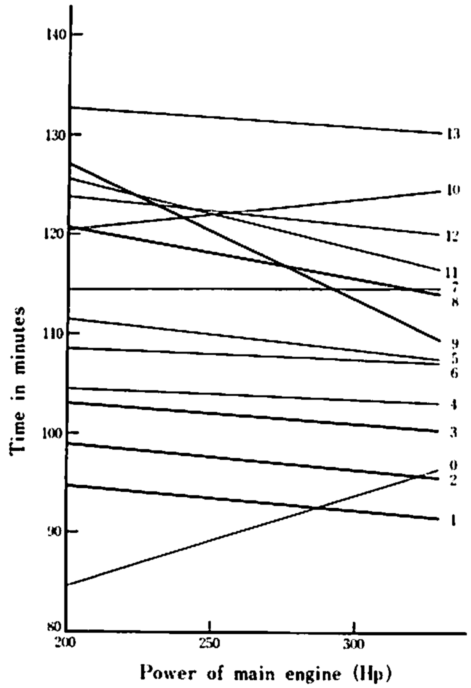

Fig. 4. The change of the t_c-p relation in accordance with the catch.

t_h and t_c slightly decreased in accordance with p. But the difference in the hauling-brailing time due to that of the power was far smaller than that due to the difference in the catch. The same trend could be found in t_c, too.

Then, the coefficients, a_{1hx}, of the different catch classes (x) were compared with one another for the purpose of examining whether the rate of decrease of the hauling-brailing time in accordance with the power differs depending on the catch or not (Table 2). And the following results were obtained: The coefficient, a_{1h0}, was significantly larger than either a_{1h1}, a_{1h2}, a_{1h3}, a_{1h6}, or a_{1h8}; and a_{1h4} was significantly larger than either a_{1h1} or a_{1h8}. But the difference of a_{1hx} between any other combinations of x was insignificant. The comparison between a_{1cx} of the different catch classes through the t-test showed that the difference between a_{1cx} was significant in the 19 combinations of x out of the 91 ones, and all the significant differences were due to either the large value of a_{1c0} and a_{1c10} or small value of a_{1c9}. The comparison of a_{1hx} with a_{1cx} showed that significant difference could not be found out between them in any of the catch classes.

The above-mentioned results suggested that the power of the boats have very small influence on the hauling-brailing time, consequently on the time required for completing a haul. But attention should be paid to the following points, before being concluded like this: The meaning of the above-mentioned results of the relation between the working time and the power differs according as the average of either t_h or t_c of the power groups shows a large variation. Namely, when the variation is small, the above-mentioned results suggest

Table 2. Comparison between a_{1hi} or between a_{1ci} of the different catch classes through the t-test.

a) Comparison of a_{1hi}

Catch class	1		2		3		4		5		6		7		8		9		10		11		12		13	
Catch class (in tons)	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n
0	2.586*	695	2.005*	1072	2.092*	1192	1.664	768	1.382	533	2.075*	291	1.381	251	2.013*	146	1.357	70	0.983	140	1.057	50	0.564	53	1.241	51
1	—		−0.927	1703	−0.848	1823	−2.077*	1399	−1.947	1164	0.391	922	−1.177	882	1.253	777	0.541	701	−1.281	771	−0.215	681	−1.048	684	0.145	682
2			—		0.128	2200	−1.230	1776	−1.224	1541	0.991	1299	−0.555	1259	1.598	1154	0.683	1078	−0.775	1148	0.017	1058	−0.685	1061	0.336	1059
3					—		−1.416	1896	−1.387	1661	0.951	1419	−0.650	1379	1.596	1274	0.675	1198	−0.857	1268	−0.008	1178	−0.732	1181	0.318	1179
4							—		−0.167	1237	1.761	995	0.206	955	2.139*	850	0.949	774	−0.193	844	0.285	754	−0.393	757	0.614	755
5									—		1.618	760	0.283	720	1.905	615	0.855	539	−0.084	609	0.283	519	−0.295	522	0.566	520
6											—		−1.076	478	0.686	373	0.300	297	−1.098	367	−0.271	277	−0.904	280	−0.002	278
7													—		1.426	333	0.684	257	−0.246	327	0.168	237	−0.374	240	0.424	238
8															—		−0.043	152	−1.301	222	−0.509	132	−1.034	135	−0.300	133
9																	—		−0.660	146	−0.333	56	−0.688	59	−0.176	57
10																			—		0.241	126	−0.185	129	0.447	127
11																					—		−0.383	39	0.177	37
12																							—		0.552	40

b) Comparison of a_{1ci}

Catch class	1		2		3		4		5		6		7		8		9		10		11		12		13	
Catch class (in tons)	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n	t	n
0	2.788**	695	2.572*	1070	2.393*	1195	2.061*	776	1.808	532	2.209*	292	1.586	249	2.238*	145	2.821**	69	0.810	137	1.844	49	1.364	52	1.241	52
1	—		0.019	1703	−0.334	1828	−1.119	1409	−0.992	1165	0.286	925	−1.528	882	1.300	778	2.710**	702	−2.497*	770	1.005	682	0.068	685	−0.188	685
2			—		−0.385	2203	−1.212	1784	−1.066	1540	0.271	1300	−1.520	1257	1.242	1153	2.471*	1077	−2.440*	1145	0.907	1057	0.057	1060	−0.177	1060
3					—		−0.886	1909	−0.781	1665	0.504	1425	−1.276	1382	1.385	1278	2.454*	1202	−2.225*	1270	0.944	1182	0.132	1185	−0.087	1185
4							—		−0.021	1246	1.016	1006	−0.655	963	1.697	859	2.523*	783	−1.673	851	1.077	763	0.314	766	0.119	766
5									—		0.897	762	−0.556	719	1.487	615	2.232*	539	−1.445	607	0.953	519	0.281	522	0.110	522
6											—		−1.285	479	0.781	375	2.010*	299	−1.942	367	0.695	279	−0.029	282	−0.229	282
7													—		1.753	332	2.487*	256	−0.925	324	1.178	236	0.495	239	0.331	239
8															—		1.400	152	−2.090*	220	0.273	132	−0.367	135	−0.553	135
9																	—		−2.416*	144	−0.903	56	−1.441	59	−1.565	59
10																			—		1.322	124	0.801	127	0.690	127
11																					—		−0.533	39	−0.644	39
12																							—		−0.128	42

Note: *significant at 0.05 level
**significant at 0.01 level

Table 3. Comparison of a_{1hx} with a_{1cx} of the same catch class through the t-test.

Catch class	t	n	Catch class	t	n
0	−0.346	63	7	−0.187	437
1	0.571	1327	8	0.390	228
2	1.499	2079	9	1.350	76
3	1.052	2324	10	−0.691	214
4	1.000	1481	11	0.810	36
5	0.834	1002	12	0.557	42
6	0.274	520	13	−0.086	40

Table 4. The linear regression equations of the working time on the catch (x in tons), estimated from the records of the hauls conducted by the boats with the engine of the same power.

a) The regression equations of the hauling-brailing time (t_h in min.) $t_h = b_{0hp} + b_{1hp}\ x$

p	b_{0hp}	b_{1hp}	F_{hp}	n_2
220	52.767	2.625	331.42**	232
230	46.396	3.390	403.95**	231
250	46.695	3.360	1936.01**	1234
270	47.856	3.156	2274.79**	1448
275	46.414	3.236	136.59**	225
290	50.646	2.331	176.53**	239
310	46.709	3.519	523.57**	236
320	48.494	3.230	1151.59**	879
340	45.019	2.766	442.75**	214

b) The regression equations of the time required for completing a haul (t_c in min.) $t_c = b_{0cp} + b_{1cp}\ x$

p	b_{0cp}	b_{1cp}	F_{cp}	n_2
220	96.151	2.896	256.86**	231
230	91.481	3.208	190.53**	231
250	91.233	3.401	1488.53**	1244
270	90.107	3.187	1402.21**	1449
275	88.494	3.251	126.73**	222
290	88.534	2.650	181.90**	241
310	89.943	3.616	313.52**	236
320	92.853	3.271	761.47**	882
340	87.304	2.595	225.00**	215

Note: df.....$n_1=1$, n_2=the value shown in the table
*significant at 0.05 level
**significant at 0.01 level

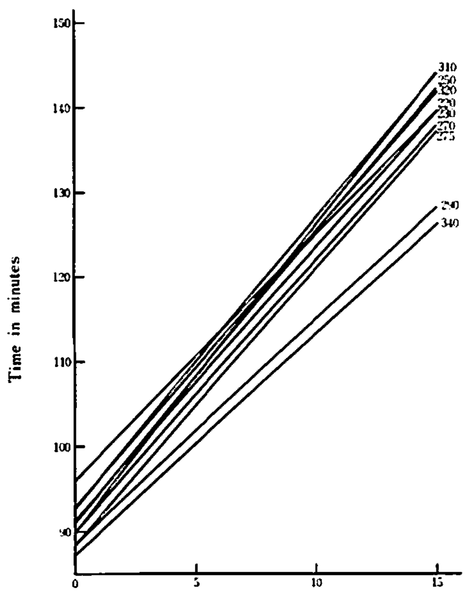

Fig. 5. The estimated regression lines of t_h on x observable among the hauls conducted by the boats with the engine of the same power.
Note: The numeral attached to the line indicates the power of the boat.

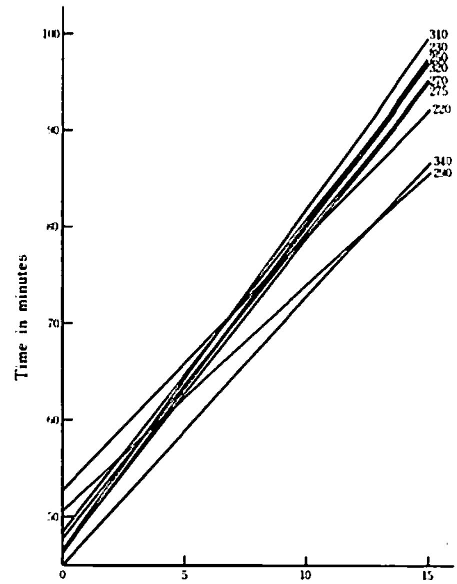

Fig. 6. The estimated regression lines of t_c on x observable among the hauls conducted by the boats with the engine of the same power.

that the power difference and the individuality of the boats should have small influence on t_h and t_c. While when the variation is large but the regression coefficient is small because of an irregular relation to the power, the influence of the individuality of the boats should be examined in detail. The observed relations were in the latter case, as shown in Figs. 1 and 2. These facts made it necessary to give further examination on the influence of the power through the comparison of the time-catch relation of the boats of the different power groups. As shown in Table 4, the coefficients, b_{1hp} and b_{1cp}, were significant at 0.01 level in all the power groups. These regression lines revealed the following trends as shown in Figs. 5 and 6: The influence of the power on either the hauling-brailing time or the time for completing a haul was far smaller than that of the catch, modifying slightly the time-catch relation. The comparison between b_{1hp} of the different power groups through the t-test showed that, among the 19 combinations of the power groups showing significant difference between b_{1hp} out of the 36 ones, the significant difference in the 17 combinations was due to the small value of either b_{1h22}, b_{1h29}, or b_{1h34}. And that of b_{1cp} showed that, among the 12 combinations of the power groups showing significant difference between b_{1cp} out of the 36 ones, the significant difference in the 10 combinations was due to the small value of either b_{1c29} or b_{1c34}. The comparison of b_{1hp} with b_{1cp} showed that the significant difference could not be found out between

Table 5. Comparison between b_{lhp} or between b_{lcp} of the different power groups through the t-test.

a) Comparison of b_{lhp}

Power group (Hp)	230 t	230 n	250 t	250 n	270 t	270 n	275 t	275 n	290 t	290 n	310 t	310 n	320 t	320 n	340 t	340 n
220	−3.456**	463	−4.279**	1466	−3.034**	1680	−2.043*	457	1.294	471	−4.242**	468	−3.008**	1111	−0.720	446
230	—		0.157	1465	1.192	1679	0.485	456	4.313**	470	−0.563	467	0.716	1110	2.935**	445
250			—		2.000*	2682	0.561	1459	5.732**	1473	−0.899	1470	1.087	2113	3.459**	1448
270					—		−0.352	1673	4.532**	1687	−2.013*	1684	−0.653	2327	2.221*	1662
275							—		2.837**	464	−0.928	461	0.022	1104	1.592	439
290									—		−5.086**	475	−4.284**	1118	−1.969	453
310											—		1.399	1115	3.713**	450
320													—		2.303*	1093

b) Comparison of b_{lcp}

Power group (Hp)	230 t	230 n	250 t	250 n	270 t	270 n	275 t	275 n	290 t	290 n	310 t	310 n	320 t	320 n	340 t	340 n
220	−1.067	462	−2.517*	1475	−1.287	1680	−1.070	453	0.920	472	−2.642**	467	−1.486	1113	1.202	446
230	—		−0.851	1475	0.081	1680	−0.117	453	1.839	472	−1.322	467	−0.220	1113	2.130*	446
250			—		1.702	2693	0.600	1466	3.656**	1485	−1.034	1480	0.907	2126	4.020**	1459
270					—		−0.227	1671	2.329*	1690	−1.838	1685	−0.584	2331	2.608*	1664
275							—		1.757	463	−1.051	458	−0.063	1104	2.000*	437
290									—		−3.409**	477	−2.413*	1123	0.211	456
310											—		1.327	1118	3.806**	451
320													—		2.672**	1097

Note: *significant at 0.05 level
**significant at 0.01 level

them in any of the power groups. These results of the examinations on the time-catch relation suggested that the difficulty to find a clear relation of either the hauling-brailing time or the time for completing a haul to the power of the boats should be due to the predominating influence of the individuality of the boats over the influence of the power of the boats.

Discussion

The regressive relations of the working time on the power after stratification of the records into the catch classes showed the different results from those before the stratification. Namely, the examination after the stratification showed that the powerful boats expended slightly shorter time on the hauling-brailing work and for completing a haul than the less powerful ones when they yielded a catch of some of the catch classes while the power had no relation to the working times of the hauls yielding a catch of some other classes. In contrast with this, the hauling-brailing time increased in accordance with the power while the time for completing a haul had no relation to the power before the

Table 6. Number of the combinations of the power groups showing significant difference of the regression coefficients.

a) The regression coefficient, b_{1hp}

Power group (Hp)		220		230		250		270		275		290		310		320		340		Sum
		L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	
Power group (Hp)	220	—		1		1		1		1				1		1				6
	230		1	—									1						1	3
	250		1			—			1				1						1	4
	270		1			1		—					1	1					1	5
	275		1							—			1							2
	290			1		1		1		1		—		1		1				6
	310		1						1				1	—					1	4
	320		1										1			—			1	3
	340			1		1		1						1		1		—		5
Sum			6	3		4		3	2	2			6	4		3			5	38/2

b) The regression coefficient, b_{1cp}

Power group (Hp)		220		230		250		270		275		290		310		320		340		Sum
		L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	
Power group (Hp)	220	—				1								1						2
	230			—															1	1
	250		1			—							1						1	3
	270							—					1						1	2
	275									—									1	1
	290					1		1				—		1		1				4
	310		1										1	—					1	3
	320												1			—			1	2
	340			1		1		1		1				1		1		—		6
Sum			2	1		3		2		1			4	3		2			6	24/2

Note: L.....significantly larger (at 0.05 level) than the others
S.....significantly smaller than the others

Table 7. Comparison of b_{1hp} with b_{1cp} of the same power groups through the t-test.

Power group (Hp)	t	n	Power group (Hp)	t	n
220	−1.175	463	290	−1.212	480
230	0.635	462	310	−0.381	472
250	−0.351	2478	320	−0.267	1761
270	−0.285	2897	340	0.785	429
275	−0.038	447			

stratification[8]. The difference of the results like this between those before and those after the stratification suggests that the trends found before the stratification should be due to the different amount of catch relating to the power of the boat. A good coincidence of a_{lcx} with a_{lhx} and b_{lcp} with b_{lhp} was due to the fact that the variation of the time required for completing a haul was chiefly due to that in the hauling-brailing time as already mentioned in the previous reports of this series[2),3),6),7)]; and it may be sufficient to give discussion on the change of the hauling-brailing time.

The examinations on the working time after the stratification either according to the catch or the power revealed the following trends: 1) the hauling-brailing time, consequently the time for completing a haul, increased in accordance with the catch in all the power groups of the boats. 2) But the rate of increase of the time in accordance with the catch had no clear relation to the power. 3) These facts resulted in the following trend: The working time showed slight decrease in accordance with the power in some of the catch classes while the time had no clear relation to the power in some other catch classes. 4) And the influence of the power on the working time was smaller than that of the catch, modifying slightly the time-catch relation. These results may be due to the following reasons: The hauling-brailing time can be divided into that for the hauling work and that for the brailing work. The latter step of work consists of the repetition of brailing by the stalked hoop net handled by the fishermen with the assistance of the winch. And it is natural that the time for this step of work increased in proportion to the catch. This makes highly significant the regression coefficient on the catch. The load of the cargo wire to handle the hoop net may be small. This makes the time for the brailing work and its increase in accordance with the catch independently of the power but rather concern with the individuality of the boat including the different work pattern and the different construction and performance of the brailing system according to the boat. These facts suggest that the influence of the power on the hauling-brailing time, consequently the time required for completing a haul, should be in the hauling step of work.

The time for the hauling work including the time expended on the work to wind up the warp varies depending on the warp length to be wound up, the load, and the performance of the hauling and winding system. The boats used the warp of the same length, but the warp length to be wound up standing against the load of the net varies according to the depth fished and the dip of the warp. The depth fished showed seasonal change but the distributions of the depth fished of the different power groups did not show any significant difference. Usually the boats hauled up the net receiving the wind from aft. And the wind drift of the boats differs boat by boat depending on the draft and superstructure but being rather independently of the power. During the earlier half of the hauling work, the warp is wound up and the dip decreases, but the net containing the catch is kept on the sea floor. The fact making the hauling speed during this step of work complicated is the different ways of the use of the engine according to the conditions: In some of the cases, the boat is propulsed ahead at dead slow speed, with an intention to prevent the boat from being towed towards the net. In some other cases, the boat is propulsed astern, with an intention to keep the warp off the large load to tow the boat towards the net. Otherwise, the engine is not in use. The way of use of the engine during this step of work differs according to the wind, the load, etc. The preference of the skipper and wind drift are also the most decisive factors to chose the way of use of the engine. During the latter half of the hauling work, the net leaves the sea floor and is towed through the water till boardside. The load during this step is the largest. The load is due to the resistance of the net with the mouth opened towards the direction to be towed. It is, accordingly, hard to consider that the increase in the resistance due to the increase of the catch occupies a large part of it, although it is natural that the load increases in accordance with the catch. The catch in water has no weight or rather shows buoyancy after being hauled up till a certain depth and may assist the hauling work. The boats were constructed suitable for far deeper grounds than in the present case. Accordingly, in the present case, whether the hauling system was driven at the full power or not is highly doubtful. And it is rather probable that the winding speed depends on the construction of the hauling system but not on the power. All of these facts make it hard to find a clear relation of the power either to the hauling-brailing time or to the rate of increase of it in accordance with the catch.

Conclusion

From all the results found in the present and the preceding report of this series[8], it may be concluded that ——

The relation of either the hauling-brailing time or the time required for completing a haul to the power found in the preceding report was due to the different amount of catch relating to the power. And the hauling-brailing time of the hauls yielding the same amount of catch showed in general a very slight —— either significant or insignificant —— decrease in accordance with the power of the boats. The same trend could be found in the time required for completing a haul. These results may be due to the following reasons: The variation of the time required for completing a haul was chiefly that in the hauling-brailing time. And it is less probable that the hauling-brailing time depends clearly on the power, because the boats were constructed suitable for fishing in far deeper grounds than those in the present case and it is highly doubtful that the hauling and the brailing works, especially the latter step of work, need the full power of the main engine of the boat but it is rather probable that the speed of these steps of works depends on some other factors —— for examples, the working pace of the crew, the construction and performance of the mechanical systems for the hauling and brailing work, etc.

Summary

The preceding reports of this series showed that the influence of the catch on the working time was far larger than that of the power of the boats. The present report dealt

with, accordingly, the relation between the working time and the power after the stratification of the records into the catch classes and the relation between the former and the catch observable among the hauls conducted by the boats with the engine of the same power, for the purpose of sweeping up the uncertainty in the results of the preceding report due to the probable difference of the catch relating to the power of the boats. And the results obtained are summarized as follows:

1. The hauling-brailing time showed a very slight decrease in accordance with the power of the boat in some of the catch classes, while the time had no relation to the power in some other catch classes. But the difference in the working time due to that of the power was smaller than that due to the difference of the catch. The same trend could be found in the time required for completing a haul, too.

2. As shown in Table 2, any clear relation could not be found between the catch and the regression coefficient of the hauling-brailing time on the power, except that the power was less influential on the hauling-brailing time of the hauls without catch than that for the hauls with a catch of some other classes. The same trend could be found in the coefficient of the time for completing a haul, too.

3. The regression coefficient of either the hauling-brailing time or the time for completing a haul on the catch observable among the hauls conducted by the boats with the engine of the same power was significant in all the power groups. But any clear relation could not be found out between the regression coefficient on the catch and the power of the boats.

4. The power needed at respective steps of fishing works was discussed, for the purpose of finding out the reason causing the above-mentioned results.

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