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Shift and Catch of the Danish Seiner during the Alaska Pollack Trawling—II.*

The Distance of Shift in Relation to the Amount of Catch before the Shift

By

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The popularization of the electronic supporting devices is one of the clearest trends of recent advances in fishing techniques. This caused a basic change in work pattern of many fishing methods. In the fleet type Danish seining for the Alaska pollack in the Eastern Bering Sea, the echo-sounder makes it possible to detect the objective schools directly; and the seiner spares unnegligible parts of the working time for scouting. And the wireless telephone supplys abundant informations from the fellow seiners. During the consecutive works, the Danish seiner repearts shooting and shift. The multiple linear regression equations of the amount of catch after the shift on the amount of catch before the shift and on the distance of shift showed that it was hard to find any clear relations except a very rough trend of yielding a good catch by the shooting after a good catch or after a long shift, probably because of the following two reasons: one is that the high order regression is not examined in the preceding report[1], in spite of the possibility of the amount of catch after the shift showing a high order regression either on the distance of shift or on the amount of catch before the shift; the other is that the relation may be complicated and should be examined sectioning into sub-steps. In the present report, accordingly, the relation observable in the sequence of catch-shift-catch was sectioned into the two sub-steps—the relations between the catch and the shift, and between the shift and the catch; and the relation observable in the former sub-step was examined by estimating the quadratic and linear regressions of the distance of shift on the amount of catch just before the shift. And the relation observable in the latter sub-step will be shown in the succeeding report.

Material and Method

The same materials as those of the preceding report were used in the present report. They were the catch records on the 15 3-consecutive days chosen randomly from all

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the catch records on the 15 10-consecutive days in the entire season of 1964 by the 22 Danish seiners fished along the outer edge of the continental shelf of the Eastern Bering Sea. And were examined the quadratic and linear regressions of the distance of shift on the amount of catch (in tons) observable either in the records on a day or in the records by a seiner. Here, the distance of shift (in miles) was used after the transformation into the square root value, for its frequency distribution was agreeable to the square root normal series.

Results

1. The quadratic regression observable within the records on the same days (The records of the long shifts excluded but those of the accidental shootings included)

The distance of shift depends on the distributions of the objective schools and of the fellow boats; and they differ daily. The amount of catch by a shooting showed a seasonal change and the evaluation of the same amount of catch by a shooting differs seasonally. Accordingly, the records were stratified according to the date. The Danish seiners sometimes shifted over a very long distance unable to be the consecutive work within a ground. The records of these long shifts were excluded. And the quadratic regression of the distance of shift on the amount of catch by the shooting just before it was examined, for the following work pattern suggested the quadratic relation: when a Danish seiner yields a good catch, she sticks to the position of the preceding shooting. When the information from the fellow seiners suggested that the probable increase of catch after the shift should bring the seiner better results filling up the loss of working time during the shift, the seiner shifts over a long distance. And when she finds a dense school and she can not yield a good catch, she may attack it again without shift.

In spite of the above-mentioned probable work pattern, the examination did not show any clear results: the relation expected from the above-mentioned pattern—the negative quadratic regression—was found in the records on the 16 days but all the estimated relations were insignificant (at 0.05 level). And the relation contrary to the expectation was found in the records on the 28 days, although all the estimated relations except those from the records on the two days were insignificant. These results threw a doubt as to the above-mentioned assumption, especially as to the short shift due to the last case i.e. the short shift after a poor catch, but they did not give any information about the former two cases. And the following possibility should be examined, before denying the quadratic relation: either when the catch-class of the estimated maximum of the shift in the convex curve is poorer than the poorest limit of the applicable catch range or when that of the estimated minimum in the concave one is far better than the best limit of the applicable range, the equations showing the convex relation and those showing the concave one mean the similar trend of the gradual decrease; either when the catch-class of the estimated maximum of shift in the convex curve is better than the best limit of the applicable catch range or when that

Table 1. The estimated quadratic regression equations of the distance of shift (y in miles, used after the square root transformation) on the amount of catch (x in tons) by the shooting just before the shift observable within the records on the same days (The records of all the 22 Danish seiners were pooled).

Date		b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
April	24	2.74	−0.35	0.02	2.61	57	2.74	−0.35	0.02	2.61	57
	25	1.71	−0.08	0.01	1.91	75	2.25	−0.22	0.01	5.81*	70
	26	1.78	−0.12	0.01	1.85	69	1.71	−0.09	0.00_5	0.86	66
May	3	1.59	−0.10	0.01	0.17	14	1.59	−0.10	0.01	0.17	14
	4	1.20	0.09	−0.01	1.40	32	2.30	−0.23	0.01	0.16	34
	5	1.70	−0.03	-0.00_{02}	0.00_2	58	2.15	−0.12	0.00_3	0.55	55
	14	2.02	−0.15	0.00_3	0.06	110	2.30	−0.27	0.01	1.08	109
	15	1.53	0.15	−0.06	3.50	69	1.88	−0.11	−0.02	0.22	66
	16	1.79	−0.63	0.13	1.93	18	1.79	−0.63	0.13	1.93	18
	25	1.71	−0.09	−0.01	0.33	78	1.77	−0.13	−0.01	0.07	72
	26	1.47	−0.31	0.06	1.65	115	1.60	−0.46	0.10	1.69	103
	27	1.42	−0.05	−0.02	0.44	128	1.44	−0.07	−0.02	0.20	121
	31	1.23	0.10	−0.04	2.73	113	1.07	0.23	−0.06	4.80*	105
June	1	1.59	−0.09	−0.01	0.15	114	1.87	−0.25	0.01	0.55	109
	2	1.73	−0.28	0.02	2.99	130	1.91	−0.39	0.04	5.21*	123
	17	1.76	−0.37	0.03	0.43	136	2.11	−0.69	0.10	3.06	133
	18	1.47	−0.24	0.03	1.33	116	1.44	−0.15	0.01	0.09	119
	19	1.49	−0.25	0.02	0.19	104	1.61	−0.35	0.04	0.59	101
	29	1.50	−0.01	0.00_1	0.01	80	1.41	0.02	-0.00_2	0.05	79
	30	2.20	−0.25	0.01	2.70	91	2.20	−0.25	0.01	2.59	90
July	1	1.61	−0.10	0.00_3	2.47	93	1.69	−0.12	0.00_4	4.14*	90
	2	1.86	−0.15	0.01	0.97	111	1.86	−0.15	0.01	0.90	110
	3	1.89	−0.18	0.01	0.71	89	1.97	−0.22	0.02	1.05	86
	4	1.76	−0.16	0.01	0.25	93	1.79	−0.18	0.01	0.27	90
	10	1.41	−0.03	0.00_2	0.01	62	2.17	−0.26	0.02	0.47	84
	11	1.85	0.01	−0.01	1.25	95	2.82	−0.35	0.02	1.50	91
	12	1.30	0.03	−0.01	1.09	64	1.38	0.01	−0.01	0.77	64
	28	1.52	0.06	−0.02	2.79	70	1.81	−0.09	−0.01	0.10	66
	29	1.81	−0.04	-0.00_3	0.52	93	2.05	−0.08	-0.00_1	0.03	98
	30	1.29	0.02	−0.01	0.82	97	1.42	−0.02	-0.00_4	0.24	97
Aug.	8	2.73	−0.42	0.03	6.01*	75	3.87	−0.78	0.06	11.21**	74
	9	1.56	−0.04	0.00_1	0.01	106	2.04	−0.22	0.02	1.80	100
	10	1.86	−0.18	0.01	0.97	70	2.46	−0.27	0.01	0.35	83
	15	2.13	−0.40	0.04	2.59	91	2.34	−0.53	0.05	5.07	90
	16	2.25	−0.53	0.06	5.25*	127	2.44	−0.66	0.08	6.64*	123
	17	1.68	−0.14	0.01	0.66	88	2.19	−0.35	0.03	5.43*	82
	23	1.38	−0.02	-0.00_4	0.03	105	1.65	−0.17	0.03	0.62	109
	24	1.46	−0.13	0.01	0.30	124	1.77	−0.28	0.02	2.70	117
	25	1.50	−0.06	−0.01	0.23	99	2.16	−0.31	0.02	0.72	105

Table 1. — (Cont'd)

Date		b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
Sept.	2	2.01	−0.47	0.07	1.43	48	2.01	−0.47	0.07	1.43	48
	3	1.64	−0.30	0.05	3.56	115	1.88	−0.44	0.06	3.56	112
	18	1.43	−0.01	-0.00_3	0.18	68	1.53	−0.04	-0.00_1	0.02	67
	19	1.48	−0.12	0.01	2.19	91	2.31	−0.37	0.02	13.15**	88
	20	1.56	−0.07	-0.00_2	0.03	99	1.53	−0.04	−0.01	0.19	89

$y = b_0 + b_1 x + b_2 x^2$ or $y = b'_0 + b'_1 x + b'_2 x^2$

The records of the accidental shootings included but those of the long shifts excluded

The records of the accidental shootings excluded but those of the long shifts included

Note: n or n' . . . . . The sample size
F_2 . . . . The estimated Snedecor's F value for b_2 with 1 and $n - 3$ degrees of freedom
F'_2 . . . . That for b'_2 with 1 and $n' - 3$ degrees of freedom
* Significant at 0.05 level ** Significant at 0.01 level

of the estimated minimum of shift in the concave one is poorer than the poorest limit, these equations mean the gradual increase. In these cases, the quadratic regression coefficient is likely to be insignificant. It is, accordingly, necessary to clarify that the above-mentioned results are either due to the bias of the catch-class of the estimated maximum (or the minimum) shift,or due to the fact that the records by different seiners of different performance and preference are pooled, or due to the fact that the distance of shift changes independently of the amount of catch yielded by the shooting just before it.

As shown in Table 2-1), the catch-classes of the estimated maximum shift in the nine convex curves were poorer than the poorest limit of the applicable catch range, and those of the estimated minimum shift in the six concave curves were better than the best limit. When the following three cases were included, the shortening trend of the shift distance was found on the 33 days, and the elongating one was on the two days.

1. The difference of the estimated distance of shift at the limit of the applicable catch range from that at the maximum (or the minimum) was less than 10% of the latter.
2. The shortening trend of shift was due to the trend in less than 10% of the records in the range from the poorest limit to the estimated maximum or from the estimated minimum to the best limit.
3. The elongating trend was due to the trend in less than 10% of the records in the range from the poorest limit to the minimum or from the estimated maximum to the best limit.

These facts suggested that the seeming variety of the results and the insignificance of the quadratic regression should be due to the location either of the catch class of the estimated maximum or of the minimum in relation to the applicable catch range. And it is conceivable that the distance of shift decreases in accordance with the amount of catch by the shooting just before the shift. Before examining the linear regression, however, it is necessary to sweep out the doubt as to the above-mentioned results were due to the following facts: in the present examination, the records of the accidental shootings were included but those of the long shifts were excluded.

2. The quadratic regression observable within the records on the same days (The records of the long shifts included but those of the accidental shootings excluded)

To clarify the above-mentioned points, the records of the long shifts were added, but those of the accidental shootings were excluded. And the quadratic regression of the distance of shift on the amount of catch by the shooting just before it was examined.

As shown in Table 1, the example of the days showing the convex relation—taking the negative b'_2—decreased from 16 to 11, although b'_2 in one of the days became significantly negative. But those showing the significantly concave relation increased from two to seven, and the insignificantly concave relation was found in the examples of the same number of days (26).

The leading trend found in the preceding section was the shortening of the distance of shift in accordance with the amount of catch by the shooting just before the shift. The same trend was found in the examination in the present section; and as shown in Table 2-2) any notable difference of the results of the present examination from those of the preceding one could be seen in neither the number of the days showing shortening trend nor the number of the days showing the elongating one. The clearest differences between the results of the present section and those of the preceding one were found in the trend observable in the range of catch-classes poorer than that of the maximum shift in the convex curve or better than that of the minimum shift in the concave curve. Among the days showing mainly the shortening trend, those showing the elongation of shift after the shooting of good catch increased from 14 to 20; and those showing the elongation of shift with catch observable in the poor catch-classes decreased from seven to two. The former may be due to the addition of the records relating to the long shifts and the latter may be due to the exclusion of those relating to the accidental shootings.

3. The linear regression

The results of the preceding two sections suggested the possibility of the linear relation with negative coefficient between the distance of shift and the amount of catch by the shooting just before the shift, in spite of the expectation of the convex relation. As shown in Table 3, the significantly negative linear regression was found on the 29 days, the insignificantly negative one was on the 12 days, but the insignificantly positive one was only on the three days. And the similar results were obtained after the exclusion of the records of the accidental shootings and the addition of those of the long shifts. These results meant that the Danish seiner inclined to shift over

Table 2. The relation between the distance of shift and the amount of catch just before the shift observable within the applicable catch range.

1) The records of the long shifts excluded but those of the accidental shootings included

	Concave							Convex							
Type*	F	D	D′	C	B	A′	A	a	a′	b	c	d′	d	f
The best limit of the applicable catch range (in tons)														
4					May 26	June 17	June 19							
5				May 16				May 27						
6				Sept. 2	Sept. 3	Aug. 16	June 18	May 25		May 31				
7						June 2 Aug. 15	June 1	May 15						
8						July 10 Aug. 24	Aug. 10							
9							May 14	July 28						
10	July 3			Aug. 23	Aug. 8 Aug. 9	July 4, 11 Aug. 25	May 4							
11				Aug. 17		April 24		Sept. 20						June 29
12						July 2			July 12					
13			May 3		Sept. 19	April 26		July 30 Sept. 18						
14						June 30								
≧15					April 25	July 1	May 5	July 29						
The number of the days in respective types	1		1	4	6	14	7	8	1	1				1

* The following abbreviations were used for representing the curves within the applicable catch range:

The catch-class at the estimated minimum of the distance of shift

Concave:
- Better than the best limit of the applicable catch range .... A
- Between the median and the best catch limit
  - The difference of the distance of shift at the best catch limit from the minimum shift being less than 10% of the latter .... A′
  - The difference being more than 10% .... B
- Between the poorest catch limit and the median
  - The difference of the distance of shift at the poorest catch limit from the minimum shift being more than 10% of the latter C
  - The difference being less than 10% .... D′
- Poorer than the poorest catch limit .... D
- The difference of the distance of shift at both of the limits of the applicable catch range from the minimum shift being less than 10% of the latter .... F

$a_1 < 0$ $0 < a_2 < 0.00005$ .... (A)

$a_1 > 0$ $0 > a_2 > -0.00005$ .... (D)

2) The records of the long shifts included but those of the accidental shootings excluded

	Concave							Convex						
Type*	F	D	D′	C	B	A′	A	a	a′	b	c	d′	d	f
The best limit of the applicable catch range (in tons) 4					May 26		June 17 June 19							
5				May 16				May 25 May 27						
6	Sept. 3			Sept. 2		June 18 Aug. 16			May 31					
7							June 2	June 1	May 15					
8						July 10 Aug. 24	Aug. 10							
9							May 14		July 28					
10					Aug. 8	July 3 July 4	Aug. 9	Aug. 23 Aug. 25	July 11	May 4				
11	June 29					April 24 Aug. 15, 17		Sept. 20						
12						July 2			July 12					
13		May 3		April 26 Sept. 19				Sept. 18	July 30					
14						June 30								
≧15		April 25				July 1		May 5 July 29						
The number of the days in respective types	2	2		4	2	12	6	9	6	1				

The catch-class at the estimated maximum of the distance of shift

Convex
- Poorer than the poorest catch limit . . . . a
- Between the poorest catch limit and the median
  - The difference of the distance of shift at the poorest catch limit from the maximum shift being less than 10% of the latter . . . . a′
  - The difference being more than 10% . . . . b
- Between the median and the best catch limit
  - The difference of the distance of shift at the best catch limit from the maximum shift being more than 10% of the latter. c
  - The difference being less than 10% . . . . d′
- Better than the best catch limit . . . . d
- The difference of the distance of shift at both of the limits of applicable catch range from the maximum shift being less than 10% of the latter . . . . f

Table 3. The estimated linear regression equations of the distance of shift (y in miles, used after the square root transformation) on the amount of catch (x in tons) by the shooting just before the shift observable within the records on the same days (The records of all the 22 Danish seiners were pooled).

Date		c_0	c_1	F_0	n	c'_0	c'_1	F'_0	n'
April	24	2.13	−0.10	7.48**	57	2.13	−0.10	7.48**	57
	25	1.48	0.01	0.10	75	1.57	-0.00_3	0.03	70
	26	1.57	−0.04	3.22	69	1.55	−0.03	2.25	66
May	3	1.22	0.01	0.06	14	1.22	0.01	0.06	14
	4	1.49	−0.05	2.51	32	2.04	−0.13	9.44**	34
	5	1.71	−0.04	3.02	58	1.82	−0.05	3.68	55
	14	1.97	−0.13	15.31**	110	2.03	−0.14	18.17**	109
	15	1.82	−0.15	8.85**	69	2.00	−0.21	15.50**	66
	16	0.74	0.15	1.33	18	0.74	0.15	1.33	18
	25	1.78	−0.16	10.74**	78	1.83	−0.18	9.25**	72
	26	1.36	−0.11	4.92*	115	1.33	−0.10	2.33	103
	27	1.49	−0.14	9.84**	128	1.52	−0.16	9.26**	121
	31	1.37	−0.06	1.72	113	1.33	−0.04	0.81	105
June	1	1.63	−0.12	15.49**	114	1.73	−0.15	17.73**	109
	2	1.58	−0.14	22.79**	130	1.60	−0.15	19.85**	123
	17	1.67	−0.25	26.29**	136	1.72	−0.27	26.80**	133
	18	1.33	−0.10	5.69*	116	1.39	−0.10	3.98*	119
	19	1.43	−0.17	10.64**	104	1.45	−0.18	10.35**	101
	29	1.48	-0.00_2	0.01	80	1.45	0.00_4	0.02	79
	30	1.94	−0.10	7.66**	91	1.93	−0.10	7.14**	90
July	1	1.50	−0.05	11.62**	93	1.53	−0.05	13.32**	90
	2	1.74	−0.08	11.15**	111	1.74	−0.08	10.54**	110
	3	1.75	−0.07	4.10*	89	1.76	−0.08	4.20*	86
	4	1.69	−0.11	9.41**	93	1.69	−0.11	8.18**	90
	10	1.39	−0.02	0.12	62	1.99	−0.14	4.97*	84
	11	2.08	−0.10	13.11**	95	2.32	−0.15	20.19**	91
	12	1.49	−0.05	6.31*	64	1.55	−0.05	7.37**	64
	28	1.72	−0.10	9.63**	70	1.87	−0.13	16.06**	66
	29	1.95	−0.09	20.91**	93	2.09	−0.09	16.53**	98
	30	1.45	−0.05	5.51*	97	1.52	−0.06	6.84*	97
Aug.	8	1.65	−0.03	0.76	75	1.64	−0.03	0.61	74
	9	1.55	−0.03	1.21	106	1.69	−0.06	2.96	100
	10	1.71	−0.08	8.16**	70	2.29	−0.17	15.70**	83
	15	1.82	−0.16	11.92**	91	1.87	−0.17	13.57**	90
	16	1.90	−0.21	31.13**	127	1.93	−0.21	29.15**	123
	17	1.59	−0.08	5.31*	88	1.71	−0.11	7.78**	82
	23	1.41	−0.05	1.17	105	1.44	−0.01	0.02	109
	24	1.41	−0.09	11.77**	124	1.47	−0.10	11.67**	117
	25	1.55	−0.10	13.39**	99	1.99	−0.19	19.83**	105

Table 3. — (Cont'd)

Date		c_0	c_1	F_0	n	c'_0	c'_1	F'_0	n'
Sept.	2	1.54	−0.09	1.60	48	1.54	−0.09	1.60	48
	3	1.43	−0.08	4.50*	115	1.51	−0.10	5.08*	112
	18	1.50	−0.04	2.68	68	1.56	−0.05	2.75	67
	19	1.30	−0.04	3.87	91	1.51	−0.07	8.06**	88
	20	1.57	−0.08	13.43**	99	1.65	−0.09	8.66**	89

$y = c_0 + c_1x$ or $y = c'_0 + c'_1x$

The records of the accidental shootings included but those of the long shifts excluded

The records of the accidental shootings excluded but those of the long shifts included

Note: n or n' . . . . . The sample size
F_0 . . . . The estimated Snedecor's F value for c_1 with 1 and n-2 degrees of freedom
F'_0 . . . . That for c'_1 with 1 and n'-2 degrees of freedom
* Significant at 0.05 level ** Significant at 0.01 level

a long distance after the shooting of a poor catch and the distance of shift was shortened in accordance with the amount of catch yielded by the shooting just before the shift.

4. The quadratic regression observable within the records by the same seiner (The records of the long shifts excluded but those of the accidental shootings included)

The examinations in the preceding sections showed the shortening trend of the distance of shift in accordance with the amount of catch yielded by the shooting just before the shift. It is, however, necessary to clarify whether or not the above-mentioned results would be observable within the records by the same seiners, because of the following reasons: The work pattern of the seiner deeply depends on the skipper's will and temperament. Some of the skippers prefer to give much importance to the informations from fellow seiners. The others inclined to decide the location of shooting gear basing mainly on the skipper's experience. The evaluation of the same amount of catch by a shooting differs according to the seiner: a certain amount of catch is better for some seiners, but it is poorer for the others. Accordingly, it is necessary to examine whether the shortening trend found in the preceding sections would be due to the seiner-by-seiner difference of the amount of catch and of the work pattern or this trend would be observable within the records by the same seiners. A sciner usually repeated less than eight hauls a day. Accordingly, the records on the consecutive three days were pooled and were stratified according to the seiner. And the quadratic regression of the distance of shift (in the square root value) on the amount of catch by the shooting just before the shift was examined.

As shown in Table 4, the quadratic regression coefficient took the positive value in the 160 strata including the six ones taking the significant (at 0.05 level) value, but took the negative value in the 143 strata including the five ones taking the significant

Table 4. The estimated quadratic regression equations of the distance of shift (y in miles, used after the square root transformation) on the amount of catch (x in tons) by the shooting just before the shift observable within the records by the same seiners and within the 3 consecutive days in the same 10-calendar-day groups.

	Seiner No.	b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
	1	2.48	−0.23	0.01	0.41	11	2.48	−0.23	0.01	0.41	11
	2	5.42	−0.97	0.06	0.43	8	5.42	−0.97	0.06	0.43	8
	3	2.56	−0.39	0.03	0.17	11	2.56	−0.39	0.03	0.17	11
	4	1.57	0.03	−0.01	0.11	13	1.57	0.03	−0.01	0.11	13
	5	1.95	−0.12	0.00_4	0.02	12	2.37	−0.27	0.02	0.17	11
	6	1.98	−0.15	0.01	0.09	12	0.97	0.22	−0.02	0.59	11
	7	1.17	0.07	-0.00_1	0.01	10	1.88	−0.09	0.01	0.16	9
	8	1.44	−0.09	0.01	0.64	13	2.51	−0.38	0.03	1.41	11
	10	1.56	0.06	−0.02	0.31	9	1.56	0.06	−0.02	0.31	9
Late in April	11	−0.56	0.96	−0.11	2.12	9	−0.56	0.96	−0.11	2.12	9
	12	4.44	−0.80	0.05	4.43	7	4.44	−0.80	0.05	4.43	7
	13	3.11	−0.34	0.02	0.35	11	3.11	−0.34	0.02	0.35	11
	14	−2.57	1.52	−0.12	89.08	4	–	–	–	–	–
	15	2.68	−0.47	0.04	1.56	11	2.68	−0.47	0.04	1.56	11
	16	1.68	0.08	−0.01	0.85	8	2.22	−0.08	-0.00_1	0.01	7
	17	0.99	0.11	0.00_1	0.00_4	7	0.99	0.11	0.00_1	0.00_4	7
	18	4.13	−0.81	0.05	3.07	7	4.13	−0.81	0.05	3.07	7
	19	2.58	−0.58	0.05	3.92	9	2.58	−0.58	0.05	3.92	9
	20	2.99	−0.48	0.03	1.85	11	2.99	−0.48	0.03	1.85	11
	21	1.91	0.05	−0.01	0.07	11	1.91	0.05	−0.01	0.07	11
	22	1.51	−0.04	0.00_1	0.00_2	7	1.28	0.05	−0.01	0.05	6
	1	1.80	−0.05	0.00_{01}	0.00_{003}	7	3.02	−0.26	0.01	0.41	8
	3	−1.25	0.53	−0.03	0.92	4	−1.25	0.53	−0.03	0.92	4
	7	1.34	−0.01	-0.00_1	0.00_{02}	6	1.34	−0.01	-0.00_1	0.00_{02}	6
	10	−1.47	1.00	−0.08	3.20	8	−1.47	1.00	−0.08	3.20	8
	11	0.72	0.37	−0.03	0.10	7	0.72	0.37	−0.03	0.10	7
	12	−0.05	0.18	-0.00_5	0.19	7	−0.05	0.18	-0.00_5	0.19	7
Early in May	14	1.95	−0.14	0.00_4	0.20	7	1.88	−0.12	0.00_3	0.02	6
	15	0.28	0.16	−0.01	0.05	5	0.28	0.16	−0.01	0.05	5
	16	1.10	0.03	-0.00_1	0.18	9	1.35	0.01	-0.00_1	0.02	9
	19	2.70	−0.22	0.01	5.29	5	2.70	−0.22	0.01	5.29	5
	20	1.00	0.16	−0.02	1.32	7	6.15	−1.21	0.07	1.71	7
	21	4.49	−0.87	0.05	5.28	9	4.49	−0.87	0.05	5.28	9
	22	4.73	−0.97	0.06	1.75	7	4.73	−0.97	0.06	1.75	7
	1	1.96	0.24	−0.09	0.20	11	1.96	0.24	−0.09	0.20	11
	2	2.08	−0.51	0.06	0.72	12	2.08	−0.51	0.06	0.72	12
	3	2.71	−0.60	0.06	0.73	7	2.71	−0.60	0.06	0.73	7
	4	2.27	−0.58	0.06	2.97	11	2.27	−0.58	0.06	2.97	11
	5	1.75	0.07	−0.03	0.24	10	1.20	0.43	−0.09	0.51	9
	6	0.41	1.11	−0.17	9.30	7	0.41	1.11	−0.17	9.30	7
	7	1.38	0.32	−0.05	0.09	6	1.38	0.32	−0.05	0.09	6
	8	−1.90	4.30	−1.08	15.97*	7	−1.90	4.30	−1.08	15.97*	7
	9	−0.51	2.14	−0.46	3.71	8	−0.51	2.14	−0.46	3.71	8
	10	1.33	0.62	−0.21	1.29	12	1.33	0.62	−0.21	1.29	12
Middle of May	11	1.49	−0.29	0.10	0.26	12	4.31	−3.16	0.75	5.03	11
	12	1.20	0.05	0.01	0.01	11	3.26	−1.30	0.21	3.21	10
	13	2.03	−0.10	−0.01	0.09	10	2.03	−0.10	−0.01	0.09	10
	15	2.54	−0.44	0.02	0.03	7	2.54	−0.44	0.02	0.03	7
	16	2.05	−0.31	0.02	0.04	10	2.05	−0.31	0.02	0.04	10
	17	3.46	−0.87	0.09	3.25	11	3.46	−0.87	0.09	3.25	11
	18	−2.05	1.68	−0.17	7.36	5	−2.05	1.68	−0.17	7.36	5
	19	−2.38	1.87	−0.20	3.72	7	−2.38	1.87	−0.20	3.72	7
	20	2.49	−0.26	-0.00_2	0.00_1	12	2.49	−0.26	-0.00_2	0.00_1	12
	21	0.83	0.13	0.01	0.08	11	−4.56	2.81	−0.29	2.43	10
	22	2.16	−0.52	0.08	1.23	10	2.16	−0.52	0.08	1.23	10

Table 4. — (Cont'd)

	Seiner No.	b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
Late in May	1	1.30	0.21	−0.12	0.34	16	1.22	0.31	−0.14	0.37	15
	2	1.79	−0.03	−0.07	0.24	20	1.63	0.15	−0.12	0.42	19
	3	0.97	0.03	−0.01	0.00_3	19	0.97	0.03	−0.01	0.00_3	19
	4	1.13	0.13	−0.01	0.02	19	0.96	0.30	−0.05	0.17	18
	5	1.07	−0.22	0.08	0.21	18	1.07	−0.22	0.08	0.21	18
	6	1.84	−0.58	0.12	1.90	17	1.39	−0.14	0.03	0.06	16
	7	1.61	0.07	−0.06	0.40	19	3.05	−1.01	0.11	0.53	16
	8	1.14	0.03	0.00_3	0.00_3	21	1.53	−0.30	0.06	0.51	18
	10	1.64	−0.08	−0.05	0.06	18	1.64	−0.08	−0.05	0.06	18
	11	1.61	−0.06	−0.01	0.12	15	1.72	−0.14	0.00_1	0.00_{02}	14
	12	0.99	0.37	−0.07	0.10	18	0.70	0.74	−0.17	0.17	17
	13	1.71	−0.64	0.13	3.97	17	−0.08	1.64	−0.44	3.01	13
	15	1.27	0.02	−0.04	0.33	18	0.93	0.33	−0.09	1.13	17
	16	1.33	0.59	−0.20	1.88	16	−0.34	2.44	−0.65	2.80	12
	17	1.45	−0.33	0.11	0.77	16	1.88	−0.85	0.24	2.24	14
	19	0.37	0.30	−0.04	0.05	5	0.37	0.30	−0.04	0.05	5
	20	1.13	0.02	−0.02	0.01	16	1.04	0.14	−0.05	0.07	15
	21	1.76	−0.36	0.06	0.87	16	1.76	−0.36	0.06	0.87	16
	22	2.07	−0.55	0.06	0.19	16	0.97	0.68	−0.24	0.95	15
Early in June	1	2.01	−0.45	0.04	0.23	14	2.01	−0.45	0.04	0.23	14
	2	1.72	−0.24	0.02	0.60	21	1.92	−0.35	0.03	1.11	18
	3	0.85	0.50	−0.14	4.21	20	0.85	0.50	−0.14	4.21	20
	4	1.12	0.19	−0.04	0.46	19	1.05	0.20	−0.04	0.17	17
	5	1.99	−0.73	0.17	3.35	14	1.99	−0.73	0.17	3.35	14
	6	1.21	0.18	−0.05	0.23	22,	1.61	−0.27	0.06	0.27	21
	7	1.94	−0.11	−0.02	0.22	21	0.65	0.53	−0.09	1.01	20
	8	1.16	−0.03	-0.00_1	0.00_{05}	17	1.21	−0.05	0.00_3	0.00_4	16
	10	1.46	−0.25	0.03	2.33	18	1.31	−0.16	0.02	0.52	17
	11	1.30	0.09	−0.04	0.19	19	2.03	−0.64	0.11	0.53	17
	12	0.95	0.37	−0.12	3.45	23	0.95	0.37	−0.12	3.45	23
	13	1.47	−0.05	−0.03	0.37	17	1.08	0.26	−0.09	2.59	14
	15	1.44	−0.06	−0.01	0.07	20	1.44	−0.06	−0.01	0.07	20
	16	2.15	−0.37	0.04	0.37	19	1.69	−0.06	-0.00_3	0.00_1	18
	17	1.70	−0.12	−0.05	0.30	20	2.64	−0.83	0.08	0.25	17
	18	2.17	−0.36	0.03	0.49	11	2.17	−0.36	0.03	0.49	11
	20	0.93	0.26	−0.05	0.40	19	1.49	−0.11	0.01	0.00_2	18
	21	1.45	0.26	−0.09	2.03	20	1.44	0.27	−0.09	1.00	19
	22	2.80	−0.93	0.11	3.91	21	2.80	−0.93	0.11	3.91	21
Middle of June	1	−1.75	3.15	−0.78	8.00*	8	−1.75	3.15	−0.78	8.00*	8
	2	1.45	0.02	−0.04	0.13	14	−0.05	1.91	−0.51	2.73	14
	3	1.18	0.28	−0.15	0.39	21	1.18	0.28	−0.15	0.39	21
	4	1.68	−0.67	0.13	0.32	21	1.68	−0.67	0.13	0.32	21
	5	1.87	−0.44	0.03	0.12	20	2.20	−0.75	0.08	0.53	19
	6	0.60	0.57	−0.15	0.94	22	0.60	0.57	−0.15	0.94	22
	7	−0.10	2.66	−0.79	4.93	7	−0.10	2.66	−0.79	4.93	7
	8	0.95	0.38	−0.14	1.68	20	0.51	0.97	−0.26	2.58	21
	9	1.20	−0.31	0.13	0.27	21	5.73	−7.11	2.40	0.00_{00001}	19
	10	1.04	0.72	−0.36	0.00_{000004}	7	1.04	0.72	−0.36	0.00_{000004}	7
	11	0.40	0.24	−0.02	0.03	20	0.40	0.24	−0.02	0.03	20
	12	1.85	−0.35	0.02	0.03	18	2.37	−0.74	0.08	0.37	18
	13	2.29	−0.76	0.09	0.57	19	2.80	−1.25	0.19	1.34	19
	15	1.61	−0.26	0.02	0.03	21	1.61	−0.26	0.02	0.03	21
	16	2.42	−1.15	0.24	1.45	22	2.42	−1.15	0.24	1.45	22
	17	1.38	0.06	−0.08	0.42	21	1.92	−0.59	0.09	0.26	19
	18	1.10	−0.02	0.01	0.00_3	7	1.10	−0.02	0.01	0.00_3	7
	19	1.05	0.01	0.02	0.04	9	1.05	0.01	0.02	0.04	9
	20	1.47	−0.36	0.06	2.19	23	1.14	−0.10	0.01	0.09	22
	21	5.00	−2.74	0.46	3.14	19	5.00	−2.74	0.46	3.14	19
	22	2.86	−1.26	0.18	1.62	16	3.04	−1.42	0.21	1.97	17
	1	1.80	−0.13	0.00_4	0.02	14	1.80	−0.13	0.00_4	0.02	14
	2	2.07	−0.25	0.01	0.47	12	2.07	−0.25	0.01	0.47	12

Table 4. — (Cont'd)

	Seiner No.	b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
Late in June	3	1.81	−0.20	0.01	0.13	12	1.81	−0.20	0.01	0.13	12
	4	4.82	−1.46	0.13	5.39*	12	4.82	−1.46	0.13	5.39*	12
	5	1.63	−0.10	0.01	0.29	11	1.63	−0.10	0.01	0.29	11
	6	1.78	−0.16	0.01	0.28	13	1.90	−0.20	0.01	0.47	12
	7	1.41	0.01	-0.00_2	0.07	12	1.00	0.14	−0.01	0.81	11
	8	0.58	0.54	−0.05	5.39*	11	0.58	0.54	−0.05	5.39*	11
	9	1.46	−0.23	0.03	0.35	16	1.46	−0.23	0.03	0.35	16
	10	2.08	−0.29	0.02	0.31	12	2.08	−0.29	0.02	0.31	12
	11	1.85	−0.18	0.01	0.65	11	1.85	−0.18	0.01	0.65	11
	12	1.70	−0.04	−0.01	0.08	17	2.21	−0.30	0.02	0.29	16
	13	2.26	−0.45	0.04	1.01	17	2.26	−0.45	0.04	1.01	17
	14	1.73	−0.08	0.00_3	0.03	11	1.73	−0.08	0.00_3	0.03	11
	15	2.23	−0.20	0.01	0.03	13	2.23	−0.20	0.01	0.03	13
	16	2.04	−0.20	0.02	0.13	7	0.80	0.55	−0.08	0.25	6
	17	2.41	−0.21	0.00_3	0.08	11	2.41	−0.12	0.00_3	0.08	11
	18	3.65	−1.08	0.22	0.01	4	3.65	−1.08	0.22	0.01	4
	19	1.64	0.07	−0.02	0.56	14	1.64	0.07	−0.02	0.56	14
	20	1.25	0.14	−0.02	0.24	11	1.25	0.14	−0.02	0.24	11
	21	0.74	0.55	−0.09	3.91	10	−0.18	1.04	−0.15	2.35	9
	22	1.16	0.31	−0.07	1.00	13	1.16	0.31	−0.07	1.00	13
Early in July	1	−0.21	0.89	−0.11	0.72	9	−0.21	0.89	−0.11	0.72	9
	2	2.20	−0.44	0.05	3.24	18	1.80	−0.25	0.02	0.36	16
	3	2.37	−0.39	0.03	1.14	11	2.37	−0.39	0.03	1.14	11
	4	1.03	0.06	−0.01	0.15	10	1.58	−0.23	0.02	0.11	9
	5	1.21	0.44	−0.09	1.87	8	1.21	0.44	−0.09	1.87	8
	6	1.63	0.19	−0.09	0.47	16	0.81	0.89	−0.23	1.13	15
	7	2.28	−0.37	0.03	0.98	19	2.28	−0.37	0.03	0.98	19
	8	2.09	−0.39	0.02	0.02	17	2.09	−0.39	0.02	0.02	17
	9	1.05	0.17	−0.02	1.47	15	1.05	0.17	−0.02	1.47	15
	10	1.47	0.18	−0.03	0.45	14	1.47	0.18	−0.03	0.45	14
	11	1.68	0.14	−0.06	0.29	15	1.68	0.14	−0.06	0.29	15
	12	1.60	−0.06	-0.00_3	0.00_5	15	1.60	−0.06	-0.00_3	0.00_5	15
	13	1.26	0.22	−0.04	1.87	15	1.26	0.22	−0.04	1.87	15
	14	2.00	−0.31	0.03	1.51	17	2.15	−0.39	0.04	1.66	16
	15	2.06	−0.23	0.02	0.19	16	2.15	−0.29	0.03	0.30	15
	16	2.76	−0.47	0.02	0.18	9	2.76	−0.47	0.02	0.18	9
	17	1.85	−0.16	0.02	0.14	16	1.85	−0.16	0.02	0.14	16
	18	1.34	0.11	−0.03	0.28	13	1.34	0.11	−0.03	0.28	13
	19	1.64	−0.11	0.02	0.10	8	5.99	−2.21	0.25	3.41	7
	20	1.61	0.02	-0.00_3	0.00_{02}	10	1.61	0.02	-0.00_3	0.00_{02}	10
	21	1.34	0.16	−0.04	0.09	12	1.34	0.16	−0.04	0.09	12
	22	2.12	−0.29	0.02	5.96*	10	2.12	−0.29	0.02	5.96*	10
Middle of July	1	1.20	−0.01	0.01	0.10	10	1.11	0.16	−0.02	0.06	11
	2	−2.27	1.77	−0.18	4.65	11	−0.33	1.09	−0.12	2.34	12
	3	1.47	0.03	−0.01	0.09	11	1.99	−0.12	0.00_4	0.04	12
	4	2.56	−0.36	0.02	0.52	10	2.54	−0.36	0.02	0.59	11
	5	–	–	–	–	–	3.09	−1.03	0.11	25.05	4
	6	1.35	0.12	−0.01	0.13	10	1.34	0.13	−0.01	0.18	11
	7	1.70	0.02	−0.01	0.25	10	2.27	−0.18	0.00_3	0.01	10
	8	1.14	0.16	−0.03	0.02	10	1.55	0.17	−0.05	0.07	12
	9	0.34	0.32	−0.02	0.08	15	1.12	0.12	−0.01	0.01	16
	10	0.50	0.30	−0.03	0.59	9	3.84	−0.68	0.04	0.92	12
	11	−0.02	0.78	−0.10	6.57*	10	1.52	0.11	−0.03	0.37	11
	12	2.90	−0.45	0.03	1.32	13	2.83	−0.43	0.03	1.33	14
	13	1.99	−0.04	−0.01	0.02	9	1.99	−0.04	−0.01	0.02	9
	14	2.67	−0.38	0.02	0.60	10	3.04	−0.48	0.03	0.92	11
	15	1.39	0.18	−0.02	2.12	11	2.07	−0.08	-0.00_2	0.01	11
	16	1.93	−0.17	0.01	0.10	13	2.05	−0.11	-0.00_2	0.00_1	14
	17	1.16	0.21	−0.03	2.37	15	1.12	0.18	−0.02	1.33	16
	18	2.04	0.36	−0.06	123.33	4	2.04	0.36	−0.06	123.33	4
	19	2.14	−0.47	0.05	0.46	6	2.14	−0.47	0.05	0.46	6

Table 4. — (Cont'd)

	Seiner No.	b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
	20	1.01	0.20	−0.03	0.68	11	2.87	−0.61	0.05	0.77	11
	21	1.37	0.11	−0.01	0.76	11	1.48	0.07	−0.01	0.29	11
	22	1.66	−0.14	0.00_4	0.06	9	2.85	−0.49	0.03	0.33	10
Late in July	1	1.80	−0.10	0.00_1	0.01	14	1.80	−0.10	0.00_1	0.01	14
	2	3.06	−0.35	0.01	1.01	14	3.06	−0.35	0.01	1.01	14
	3	1.39	0.05	−0.01	0.18	15	1.39	0.05	−0.01	0.18	15
	4	1.88	−0.14	0.01	0.15	13	1.28	0.17	−0.02	0.43	13
	5	–	–	–	–	–	−1.09	2.10	−0.30	1.72	4
	6	−1.61	1.19	−0.11	2.46	14	−1.61	1.19	−0.11	2.46	14
	7	0.92	0.11	−0.01	0.31	11	0.23	0.37	−0.03	1.23	12
	8	1.49	−0.09	0.01	0.32	13	1.49	−0.09	0.01	0.32	13
	9	1.66	−0.19	0.02	0.51	15	1.66	−0.19	0.02	0.51	15
	10	2.30	−0.36	0.02	0.70	13	2.73	−0.63	0.06	11.29**	14
	11	1.60	−0.10	0.01	0.08	12	1.60	−0.10	0.01	0.08	12
	12	1.11	0.52	−0.07	4.53	10	2.66	−0.08	−0.01	0.06	9
	13	1.49	0.15	−0.04	0.34	14	1.49	0.15	−0.04	0.34	14
	14	1.03	0.08	−0.01	0.18	10	−1.46	0.81	−0.05	0.52	12
	15	1.35	0.09	−0.01	0.86	13	2.35	−0.23	0.01	0.13	13
	16	1.39	0.07	−0.01	0.04	14	2.74	−0.48	0.04	0.53	13
	17	1.30	0.13	−0.02	2.13	13	2.24	−0.24	0.01	0.18	11
	18	1.86	−0.22	0.01	0.74	7	1.86	−0.22	0.01	0.74	7
	19	1.25	0.40	−0.07	2.64	6	1.25	0.40	−0.07	2.64	6
	20	1.33	−0.12	0.01	0.80	11	0.03	0.27	−0.01	0.12	10
	21	1.12	0.25	−0.04	0.36	11	0.92	0.39	−0.05	0.81	12
	22	1.74	−0.07	0.00_1	0.00_4	14	1.74	−0.07	0.00_1	0.00_4	14
Early in Aug.	1	1.41	0.17	−0.04	1.24	13	1.55	0.11	−0.03	0.05	12
	2	0.30	0.32	−0.03	0.03	10	6.77	−1.98	0.17	9.92*	11
	3	8.53	−3.63	0.41	4.42	8	8.53	−3.63	0.41	4.42	8
	4	0.30	0.69	−0.08	0.92	12	0.30	0.69	−0.08	0.92	12
	6	2.28	−0.39	0.04	3.94	13	2.72	−0.44	0.04	1.91	15
	7	1.06	0.14	−0.02	0.57	13	2.46	−0.30	0.01	0.07	13
	8	8.23	−2.13	0.15	6.25*	12	8.23	−2.13	0.15	6.25*	12
	9	1.60	0.09	−0.03	0.39	11	3.14	−0.50	0.03	0.05	11
	10	1.85	−0.06	0.00_{03}	0.00_{01}	14	1.85	−0.06	0.00_{03}	0.00_{01}	14
	11	3.42	−0.91	0.09	18.01**	11	3.18	−0.76	0.07	7.46*	12
	12	5.10	−1.12	0.08	1.68	11	5.10	−1.12	0.08	1.68	11
	13	1.49	−0.12	0.04	0.04	11	2.48	−0.62	0.10	0.26	12
	14	1.29	0.14	−0.02	0.24	13	1.58	0.04	−0.01	0.10	14
	15	1.00	0.09	−0.01	0.11	9	4.63	−0.86	0.05	0.13	10
	16	2.06	−0.40	0.05	0.59	12	3.23	−0.88	0.10	1.47	13
	17	1.52	−0.13	0.02	2.00	14	2.07	−0.23	0.03	0.75	12
	18	3.27	−0.59	0.04	0.42	12	3.27	−0.59	0.04	0.42	12
	19	2.44	−0.40	0.03	1.42	14	2.44	−0.40	0.03	1.42	14
	20	1.98	−0.23	0.02	0.51	13	2.94	−0.54	0.04	1.33	13
	21	−7.14	3.45	−0.33	0.62	11	3.98	−1.05	0.12	0.67	12
	22	1.94	−0.33	0.03	2.02	12	1.94	−0.33	0.03	2.02	12
Middle of Aug.	1	1.65	0.05	−0.04	0.17	18	3.15	−1.10	0.15	1.50	16
	2	1.42	−0.08	0.01	0.07	17	1.42	−0.08	0.01	0.07	17
	3	2.01	−0.31	0.03	0.08	11	2.01	−0.31	0.03	0.08	11
	4	1.68	−0.19	0.01	0.22	17	2.49	−0.60	0.05	4.90*	16
	6	2.10	−0.48	0.09	0.18	16	2.29	−0.63	0.12	0.31	15
	7	1.83	−0.10	−0.01	0.02	17	1.83	−0.10	−0.01	0.02	17
	8	2.30	−0.47	0.03	0.05	13	2.30	−0.47	0.03	0.05	13
	9	1.79	−0.36	0.03	0.33	17	1.79	−0.36	0.03	0.33	17
	10	1.70	−0.15	0.00_1	0.00_2	17	1.70	−0.15	0.00_1	0.00_2	17
	11	1.49	−0.28	0.04	0.79	18	1.49	−0.28	0.04	0.79	18
	12	6.02	−3.31	0.54	7.17*	15	6.02	−3.31	0.54	7.17*	15
	13	2.42	−0.27	−0.04	0.10	15	2.42	−0.27	−0.04	0.10	15
	14	2.20	−0.30	−0.01	0.02	18	2.84	−0.80	0.08	0.51	17
	15	1.60	−0.10	0.00_4	0.01	15	1.83	−0.23	0.02	0.13	13
	16	2.01	−0.14	0.01	0.12	15	3.32	−0.68	0.05	3.86	14

Table 4. —(Cont'd)

	Seiner No.	b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
	17	1.87	−0.21	0.02	0.09	17	1.87	−0.21	0.02	0.09	17
	20	3.35	−1.20	0.15	3.30	18	3.51	−1.26	0.15	3.66	17
	21	3.03	−0.84	0.08	0.41	14	3.98	−1.34	0.14	2.13	13
	22	1.98	−0.10	−0.02	0.08	18	2.23	−0.25	0.00_2	0.00_{02}	17
Late in Aug.	1	0.88	0.14	−0.02	1.41	20	0.85	0.15	−0.02	0.76	20
	2	1.35	−0.17	0.05	0.50	16	0.15	0.48	−0.01	0.00_2	18
	3	1.13	−0.08	0.01	0.05	16	2.66	−0.95	0.13	0.69	15
	4	2.18	−0.51	0.04	0.07	13	1.75	−0.02	−0.07	0.14	13
	5	−0.43	0.57	−0.06	3.62	6	−0.43	0.57	−0.06	3.62	6
	6	1.06	0.39	−0.07	1.01	15	0.39	1.05	−0.20	1.50	14
	7	0.95	0.15	−0.02	0.23	17	1.78	−0.30	0.04	1.28	18
	8	1.35	0.06	−0.03	0.17	16	1.96	−0.19	-0.00_4	0.00_1	16
	9	1.00	0.08	−0.02	0.29	15	2.22	−0.81	0.12	1.97	12
	10	2.50	−0.51	0.05	0.55	15	2.21	−0.44	0.08	0.46	16
	11	1.88	−0.37	0.03	0.06	15	2.79	−0.97	0.13	0.82	17
	12	1.00	0.15	−0.03	0.09	16	1.00	0.15	−0.03	0.09	16
	13	1.57	0.20	−0.08	2.80	18	2.02	−0.06	−0.04	0.90	17
	14	1.77	−0.31	0.02	0.10	16	1.69	−0.09	−0.02	0.06	17
	15	2.92	−1.03	0.14	2.30	17	4.75	−2.01	0.27	3.94	18
	16	0.81	0.54	−0.14	0.58	15	0.81	0.54	−0.14	0.58	15
	17	1.56	−0.09	-0.00_2	0.00_1	18	0.88	0.60	−0.13	0.43	16
	18	1.48	−0.30	0.03	9.10	6	1.27	−0.21	0.02	0.23	5
	19	1.15	0.39	−0.11	0.71	8	0.84	0.65	−0.12	0.13	10
	20	2.50	−0.59	0.05	1.71	18	3.23	−0.88	0.08	2.17	19
	21	1.75	−0.45	0.07	1.94	13	2.65	−0.71	0.08	1.11	14
	22	2.09	−0.31	0.02	0.07	19	2.09	−0.31	0.02	0.07	19
Early in Sept.	1	2.34	−1.17	0.24	9.00*	9	2.34	−1.17	0.24	9.00*	9
	2	1.76	−0.53	0.09	1.23	9	4.82	−2.32	0.35	7.58*	9
	3	−1.96	1.82	−0.26	0.51	9	−1.96	1.82	−0.26	0.51	9
	4	1.67	−0.18	−0.02	0.04	10	2.47	−0.83	0.10	0.42	9
	6	1.68	−0.28	0.04	0.11	9	1.68	−0.28	0.04	0.11	9
	7	2.33	−0.65	0.10	0.07	8	2.33	−0.65	0.10	0.07	8
	8	1.71	−0.34	0.04	0.02	6	1.71	−0.34	0.04	0.02	6
	9	2.07	−0.97	0.28	0.66	8	5.48	−4.27	1.03	2.51	7
	10	1.67	−0.34	0.05	0.04	10	1.67	−0.34	0.05	0.04	10
	11	0.17	1.04	−0.26	0.84	10	0.17	1.04	−0.26	0.84	10
	12	1.90	−0.44	0.05	0.03	9	1.90	−0.44	0.05	0.03	9
	13	0.96	0.42	−0.10	0.36	9	0.96	0.42	−0.10	0.36	9
	14	2.14	−0.75	0.13	0.49	6	2.14	−0.75	0.13	0.49	6
	15	1.66	−0.08	-0.00_2	0.00_1	9	0.98	0.38	−0.07	0.36	8
	16	4.19	−1.93	0.32	0.37	6	4.97	−2.46	0.40	3.18	7
	17	−1.35	3.40	−0.85	9.11*	8	−0.68	2.85	−0.74	7.03	7
	20	3.03	−1.79	0.41	0.67	10	3.03	−1.79	0.41	0.67	10
	21	5.73	−2.84	0.40	2.71	8	5.73	−2.84	0.40	2.71	8
	22	−0.55	1.90	−0.41	1.37	9	−0.55	1.90	−0.41	1.37	9
Middle of Sept.	1	2.52	−0.45	0.06	0.47	7	3.15	−0.79	0.10	0.68	6
	2	1.62	0.03	−0.02	0.59	14	2.94	−0.41	0.02	0.12	13
	3	1.91	−0.31	0.03	0.24	10	4.54	−1.14	0.09	3.72	11
	4	0.99	0.14	−0.03	1.02	12	0.68	0.31	−0.05	0.34	10
	5	1.67	−0.14	0.01	0.17	13	2.29	−0.44	0.04	3.02	12
	6	1.54	−0.29	0.04	1.48	11	1.54	−0.29	0.04	1.48	11
	7	1.62	−0.28	0.02	1.64	13	0.10	0.24	−0.02	0.13	12
	8	0.95	0.17	−0.02	1.28	14	1.04	0.20	−0.03	1.39	15
	9	2.50	−1.11	0.18	1.43	8	2.50	−1.11	0.18	1.43	8
	10	2.68	−0.55	0.04	0.77	11	2.68	−0.55	0.04	0.77	11
	11	1.31	−0.43	0.08	4.06	12	4.62	−1.93	0.23	12.26*	9
	12	2.50	−0.40	0.03	2.83	10	1.60	−0.06	-0.00_3	0.00_4	9
	13	1.42	−0.05	0.00_4	0.10	15	2.77	−0.45	0.03	1.91	13
	14	2.08	−0.29	0.01	1.10	11	2.08	−0.29	0.01	1.10	11
	15	2.65	−0.43	0.03	1.40	11	3.17	−0.62	0.04	0.41	10

Table 4. — (Cont'd)

	Seiner No.	b_0	b_1	b_2	F_2	n	b'_0	b'_1	b'_2	F'_2	n'
Middle of Sept.	16	1.29	0.09	−0.01	0.98	15	1.29	0.09	−0.01	0.98	15
	17	1.25	0.00_3	-0.00_4	0.96	12	1.62	−0.10	0.00_2	0.08	11
	18	1.36	−0.03	-0.00_1	0.02	15	1.60	−0.09	0.00_3	0.02	14
	19	1.35	−0.06	-0.00_{002}	0.00_{0001}	14	2.13	−0.37	0.03	0.23	13
	20	1.09	0.07	-0.00_6	0.11	10	4.18	−0.75	0.04	1.69	10
	21	0.87	0.19	−0.02	1.18	9	−0.72	0.72	−0.05	0.97	9
	22	1.47	−0.16	0.02	0.11	11	1.47	−0.16	0.02	0.11	11

$y = b_0 + b_1x + b_2x^2$ or $y = b'_0 + b'_1x + b'_2x^2$

The records of the accidental shootings included but those of the long shifts excluded

The records of the accidental shootings excluded but those of the long shifts included

Note: n or n' . . . . . The sample size
F_2 . . . . The estimated Snedecor's F value for b_2 with 1 and $n-3$ degrees of freedom
F'_2 . . . . That for b_2 with 1 and $n'-3$ degrees of freedom
* Significant at 0.05 level ** Significant at 0.01 level

Table 5. The seiner-by-seiner difference of the quadratic coefficient in the quadratic regression equations.

1) The records of the accidental shootings included but those of the long shifts excluded

		Seiner No.																						Sum
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
b_2	+	1			1				1			1	1										1	6
	(+)	7	9	8	6	6	7	3	6	6	8	6	7	6	7	8	9	7	7	6	7	7	11	154
	(−)	6	5	7	7	3	7	12	5	5	7	7	7	8	4	7	6	6	4	6	8	8	3	138
	−	1							2			1						1						5
Sum		15	14	15	14	9	14	15	14	11	15	15	15	14	11	15	15	14	11	12	15	15	15	303

2) The records of the accidental shootings excluded but those of the long shifts included

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Sum
b'_2	+	1	2		2				1		1	2	1										1	11
	(+)	7	8	9	5	7	7	7	7	8	8	7	7	5	7	10	7	11	8	7	10	7	10	169
	(−)	6	4	6	7	4	7	8	4	3	6	6	7	9	3	5	8	3	3	5	5	8	4	121
	−	1							2															3
Sum		15	14	15	14	11	14	15	14	11	15	15	15	14	10	15	15	14	11	12	15	15	15	304

Note: The numerals in respective columns show the number of the groups of the records stratified according to the seiner and the season (the 10-calendar-day intervals).

$y = b_0 + b_1x + b_2x^2$ or $y = b'_0 + b'_1x + b'_2x^2$

x . . . . . . The amount of catch (in tons) by the shooting just before the shift
y . . . . . . The distance of shift (in miles, used after the square root transformation)
\+ . . . . . . Significantly positive at 0.05 level
(+) . . . . . Insignificantly positive
(−) . . . . . Insignificantly negative
− . . . . . Significantly negative

Table 6. The seasonal change of the quadratic coefficient in the quadratic regression equations.

1) The records of the accidental shootings included but those of the long shifts excluded

		April	May			June			July			Aug.			Sept.		Sum
		l	e	m	l	e	m	l	e	m	l	e	m	l	e	m	
b_2	+							1	1			2	1		1		6
	(+)	14	5	10	7	7	12	14	9	7	10	11	13	11	11	13	154
	(−)	7	8	10	12	12	8	6	12	13	11	8	5	11	6	9	138
	−			1			1	1		1					1		5
Sum		21	13	21	19	19	21	22	22	21	21	21	19	22	19	22	303

2) The records of the accidental shootings excluded but those of the long shifts included

		April	May			June			July			Aug.			Sept.		Sum
		l	e	m	l	e	m	l	e	m	l	e	m	l	e	m	
b_2'	+							1	1		1	3	2		2	1	11
	(+)	13	5	9	7	11	13	14	10	10	10	15	15	10	11	15	169
	(−)	7	7	11	12	8	7	6	11	12	11	3	2	12	6	6	121
	−			1			1	1									3
Sum		20	13	21	19	19	21	22	22	22	22	21	19	22	19	22	304

value. Accordingly, the presence of the significant coefficient and whether the coefficient was positive or negative were meaningful only when the distributions of either the strata taking the significant coefficient or those taking the positive one have some relations either to the season or to the seiner; otherwise, the possibility of the distance of shift changing with the amount of catch yielded by the shooting just before the shift keeping the quadratic relation should be denied, for the phrase "significant at 0.05 level" means that the estimated F-value in about 5% of the strata takes larger value than that shown in the F-table even when the distance of shift does not show any quadratic relation to the amount of catch.

The strata taking the significant quadratic regression coefficient scattered over the seven seiners; and it was hard to find any differences of these seiners from the others in many respects. The significant coefficients were scattering over throughout the seasons. In regard to the seiner-by-seiner difference of the rate of the strata taking the positive coefficient, the rate seemed to vary according to the seiner from 3/15 (by the seiner 7) to 12/15 (by the seiner 22); but it was hard to say that the rate differed according to the seiner [$\chi_0^2 = 15.18$ with 21 degrees of freedom; $0.900 > \Pr\{\chi_0^2 > \chi^2\} > 0.750$]. In regard to seasonal change, the rate seemed to differ according to the season from 7/21 (in the middle of July) to 14/19 (in the middle of August), but it was hard to say that the rate significantly differed seasonally [$\chi_0^2 = 18.21$ with 14 degrees of freedom; $0.25 > \Pr\{\chi_0^2 > \chi^2\} > 0.10$. The Snedecor's F-value of the i-th order coefficient in the i-th order regression equation of the rate (after the arc sine transformation) on the season (the number of the 10-calendar-day strata counted from the late in April) were as follows: $F_3 = 1.20$, $F_2 = 0.88$, and $F_1 = 1.70$; with 1 and 15

$- i - 1$ degrees of freedom].

5. The quadratic regression observable within the records by the same seiners (The records of the long shifts included but those of the accidental shootings excluded)

The exclusion of the records of the accidental shootings and the addition of those of the long shifts made the quadratic regression coefficient b'_2 incline to take the positive value, although the difference of the results of the present section from those of the preceding section was very slight. And about 60% of the strata took the positive b'_2, although only the 11 strata out of the 304 ones took the significantly positive coefficient. In regard to the seiner-by-seiner difference, the rate of the strata taking the positive coefficient seemed to vary according to the seiner from 5/14 (by the seiner 13) to 11/14 (by the seiner 17); but it was hard to say that the rate significantly differed according to the seiner [$\chi_0^2 = 14.79$ with 21 degrees of freedom; $0.90 > \Pr\{\chi_0^2 > \chi^2\} > 0.75$]. In regard to seasonal change, the rate of the strata taking the positive b'_2 significantly differed seasonally from 7/19 (in late in May) to 17/19 (in the middle of August) [$\chi_0^2 = 28.90$ with 14 degrees of freedom; $0.025 > \Pr\{\chi_0^2 > \chi^2\} > 0.010$] but it was hard to say that the rate showed a clear seasonal change [$F_3 = 0.92$, $F_2 = 0.14$, and $F_1 = 3.39$; with 1 and $15 - i - 1$ degrees of freedom]. All the results in the present and in the preceding sections meant that it was hard to say that the distance of shift changed in accordance with the amount of catch yielded by the shooting just before the shift keeping a quadratic relation.

6. The quadratic relation within the applicable range of the estimated equations

The examinations in the preceding sections showed that it was hard to say that the distance of shift changed in accordance with the amount of catch yielded by the shooting just before the shift keeping the quadratic relation. And b_2 took the positive value in a little more than a half of the strata, but the coefficient took the negative value in the other strata. Before concluding that the distance of shift changed independently of the amount of catch just before the shift, however, it is necessary to examine the distribution of the records in relation to the catch-class of the estimated maximum (or minimum) of shift. The leading trend found within the applicable catch range of the estimated equations was the shortening one with the amount of catch yielded by the shooting just before the shift either before or after the exclusion of the records of the accidental shootings and the addition of those of the long shifts as shown by the following facts: 1) the shortening trend was found in the 85 strata (or 90 ones, after the exclusion of the records of the accidental shootings and the addition of those of the long shifts) taking the negative b_2 and in the 75 strata (or 62 ones) taking the positive b_2; 2) the elongating trend was found in the 14 strata (or nine ones) taking the positive b_2 and in the 11 strata (or nine ones) taking the negative b_2; 3) the mainly shortening but partly elongating trend was found in the 39 strata (or 55

Table 7. The seiner-by-seiner and seasonal difference of the shift-catch relation within the applicable catch range (The records of the accidental shootings included but those of the long shifts excluded).

	Seiner No. 1	2	3	4	5	6	7	8	9	10	11	12
Late in April	A′(14) (11.5)	B(10) (8.1)	A′(7) (6.5)	a′(11) 1.5	A(9) (15.0)	A′(9) (7.5)	d(13) 35.0	D′(12) 4.5		a(10) 1.5	a′(7) 4.4	B(13) (8)
Early in May	A(18) (250.0)		c(12) 8.8				a(11) −5.0			b(10) 6.3	b(10) 6.2	d′(20) 18.0
Middle of May	a′(5) 1.3	A′(5) (4.3)	C(9) (5.0)	C(9) (4.8)	a′(5) 1.2	b(6) 3.3	a′(8) 3.2	b(3) 2.0	b(4) 2.3	a′(4) 1.5	C(3) (1.5)	D(5) (−2.5)
Late in May	a′(3) 0.9	a(3) −0.2	f(4)	d′(4) 6.5	D′(3) (1.4)	B(4) (2.4)	a′(5) 0.6	D(5) (−5.0)		a(4) −0.8	a(6) −3.0	d′(3) 2.6
Early in June	A′(6) (5.6)	A′(7) (6.0)	b(4) 1.8	b(5) 2.4	B(4) (2.1)	d′(3) 1.8	a(6) −2.8	a(7) −15.0		B(6) (4.2)	a′(4) 1.1	b(4) 1.5
Middle of June	c(3) 2.0	a′(3) 0.3	a′(3) 0.9	A′(3) (2.6)	A(5) (7.3)	b(3) 1.9	b(3) 1.7	a′(4) 1.4	A′(2) (1.2)	a′(2) 1.0	d(4) 6.0	A(4) (8.8)
Late in June	A(12) (16.3)	A(10) (12.5)	A(9) (10.0)	B(7) (5.6)	C(10) (5.0)	A(8) (8.0)	a′(21) 2.5	b(10) 5.4	B(6) (3.8)	A(7) (7.3)	B(14) (9.0)	a(8) −2.0
Early in July	c(6) 4.0	B(7) (4.4)	B(11) (6.5)	f(6)	b(5) 2.4	a′(4) 1.1	A′(7) (6.2)	A(5) (9.8)	B(8) (4.3)	a′(8) 3.0	a′(5) 1.2	a(8) −10.0
Middle of July	D′(7) (0.5)	b(8) 4.9	a′(12) 1.5	A′(10) (9.0)		d′(10) 6.0	a′(10) 1.0	a′(5) 2.7	c(5) 8.0	a′(10) 5.0	b(7) 3.9	A′(8) (7.5)
Late in July	A(12) (50.0)	A(15) (17.5)	a′(10) 2.5	A′(10) (7.0)		c(7) 5.4	a′(12) 5.5	D′(12) (4.5)	A′(7) (4.8)	A(8) (9.0)	F(8)	b(8) 3.7
Early in Aug.	b(6) 2.1	f(7)	C(6) (4.4)	b(8) 4.3		C(10) (4.9)	b(10) 3.5	B(10) (7.1)	a′(7) 1.5	A(10) (100.0)	C(10) (5.1)	A′(8) (7.0)
Middle of Aug.	a′(5) 0.6	F(6)	A(5) (5.2)	A(8) (9.5)		A′(3) (2.7)	a(7) −5.0	A(4) (7.8)	A(5) (6.0)	A(6) (75.0)	B(6) (3.5)	B(4) (3.1)
Late in Aug.	b(7) 3.5	C(5) (1.7)	A′(5) (4.0)	A(4) (6.4)	B(7) (4.8)	d′(4) 2.8	b(7) 3.8	a′(5) 1.0	a′(5) 2.0	A′(6) (5.1)	A(4) (6.2)	a′(5) 2.5
Early in Sept.	C(4) (2.4)	A′(4) (2.9)	d′(4) 3.5	a(4) −4.5		A(3) (3.5)	D′(5) (3.3)	A(4) (4.3)	B(3) (1.7)	D′(5) (3.4)	b(3) 2.0	A(3) (4.4)
Middle of Sept.	A′(6) (3.8)	a′(10) 0.8	C(10) (5.2)	b(7) 2.3	A′(8) (7.0)	C(7) (3.6)	B(9) (7.0)	c(8) 4.3	C(5) (3.1)	A′(7) (6.9)	C(7) (2.7)	A′(8) (6.7)
A,A′,a,a′,(A)	9	8	7	7	4	5	9	7	5	12	5	8
B		2	1	1	2	1	1	1	3	1	2	2
b	2	1	1	3	1	2	3	2	1	1	3	2
C	1	1	3	1	1	2			1		3	
c	2		1			1		1	1			
D,D′,d,d′,(D)	1		1	1	1	3	2	3		1	1	3
F,f		2	1	1							1	

Legend:

Type (shown in Table 2) → A′ (14) ← Applicable range, extending 14 tons

(11.5) ← The catch-class at the estimated minimum of shift

ones) taking the negative b_2 and in the 37 strata (or 36 ones) taking the positive b_2, and 4) the mainly elongating but partly shortening trend was found in the 20 strata (or 22 ones) taking the negative b_2 and in the 14 strata (also 14 ones) taking the positive b_2.

13	14	15	16	17	18	19	20	21	22	A,A',a, a'(A)	B	b	C	c	D,D',d, d'(D)	F,f
B(12) (8.5)	c(9) 6.3	C(10) (5.9)	a'(13) 4.0	D(14) (−55.0)	C(12) (8.1)	B(10) (5.8)	C(13) (8.0)	a'(10) 2.5	A(10) (20)	10	4		3	1	3	
	A(13) (17.5)	a'(13) 8.0	d'(18) 15.0			B(18) (11.0)	b(10) 4.0	B(12) (8.7)	B(10) (8.1)	4	3	3		1	2	
a(8) (−5.0)		A(7) (11.0)	A(6) (7.8)	B(7) (4.8)	b(8) 4.9	c(7) 4.7	a(7) −65.0	D(6) (−6.5)	B(5) (3.3)	9	2	4	3	1	2	
B(4) (2.5)		a'(4) 0.3	b(3) 1.5	c(3) 1.5		d'(5) 3.8	a'(3) 0.5	A'(4) (3.0)	A(3) (4.6)	9	2	1		1	5	1
a(4) −0.8		a(6) −3.0	A'(5) (4.6)	a(4) −1.2	A'(6) (6.0)		c(5) 2.6	b(5) 1.4	B(6) (4.2)	10	3	4		1	1	
A(4) (4.2)		A(4) (6.5)	A(3) (2.4)	a'(3) 0.4	D(6) (1.0)	D(4) (−0.3)	B(5) (3.0)	C(4) (3.0)	A(3) (3.5)	13	1	2	1	1	3	
A'(7) (5.6)	A(10) (13.3)	A(10) (10.0)	A'(6) (5.0)	A(17) (20.0)	A'(3) (2.5)	a'(10) 1.8	a'(10) 3.5	c(6) 3.1	a'(6) 2.2	16	3	1	1	1		
b(7) 2.8	A'(7) (5.2)	A'(7) (5.8)	A(7) (11.8)	b(7) 4.0	a'(7) 1.8	D'(7) (2.8)	f(4)	a'(4) 2.0	B(12) (7.3)	11	4	3		1	1	2
a(9) −2.0	A(9) (9.5)	b(12) 4.5	A(8) (8.5)	b(8) 3.5	a'(8) 3.0	B(7) (4.7)	b(7) 3.3	c(10) 5.5	A(10) (17.5)	11	1	5		2	2	
a'(7) 1.9	a(12) 4.0	b(10) 4.5	f(8)	a'(8) 3.3	A'(12) (11.0)	b(7) 2.9	B(10) (6.0)	a'(8) 3.1	A(10) (35.0)	13	1	3		1	1	2
D'(5) (1.5)	a'(8) 3.5	f(7)	C(7) (4.0)	C(10) (3.3)	A'(9) (7.4)	B(10) (6.7)	B(10) (5.8)	c(6) 5.2	A'(7) (5.5)	6	3	3	5	1	1	2
a(4) −3.4	a(4) −15.0	A(6) (12.5)	A'(11) (7.0)	A'(6) (5.3)			B(5) (4.0)	A(5) (5.3)	a(5) −2.5	15	3					1
a'(5) 1.3	A(5) (7.8)	B(5) (3.7)	a'(4) 1.9	a(4) −22.5	B(8) (5.0)	a'(4) 1.8	A'(7) (5.9)	C(6) (3.2)	A(5) (7.8)	14	3	2	2		1	
b(4) 2.1	B(4) (2.9)	a(5) −20.0	B(4) (3.0)	b(3) 2.0			B(3) (2.2)	B(5) (3.6)	c(3) 2.3	6	5	3	1	1	3	
A'(12) (6.3)	A(10) (14.5)	A'(8) (7.2)	a'(10) 4.5	a'(13) 0.4	a(11) −15.0	a(7) −1500.0	b(12) 5.8	b(10) 4.8	A'(6) (4.0)	13	1	3	4	1		
9	9	10	10	7	7	3	4	5	10							
2	1	1	1	1	1	4	5	2	4							
2		2	1	3	1	1	3	2								
		1	1	1	1		1	2								
	1			1		1	1	3	1							
1			1	1	1	3		1								
		1	1				1									

Type (shown in Table 2) → a' (11) ← Applicable range, extending 11 tons

1.5 ← The catch-class at the estimated maximum of shift

Table 8. The seiner-by-seiner and seasonal difference of the shift-catch relation within the applicable catch range (The records of the accidental shootings excluded but those of the long shifts included).

	Seiner No.											
	1	2	3	4	5	6	7	8	9	10	11	12
Late in April	A'(14) (11.5)	B(10) (8.1)	A'(7) (6.5)	a(11) 1.5	A'(9) (6.8)	b(9) 5.5	D'(13) (4.5)	C(12) (6.3)		a'(10) 1.5	b(7) 4.4	B(13) (8.0)
Early in May	B(18) (13)		c(12) 8.8				a(11) −5.0			b(10) 6.3	b(10) 6.2	d'(20) 18.0
Middle of May	a'(5) 1.3	A'(5) (4.3)	C(9) (5.0)	C(9) (4.8)	a'(5) 2.4	b(6) 3.3	a'(8) 3.2	b(3) 2.0	b(4) 2.3	a'(4) 1.5	B(3) (2.1)	B(5) (3.1)
Late in May	b(3) 1.1	a'(3) 0.6	f(4)	c(4) 3.0	D'(3) (1.4)	F(4)	A'(5) (4.6)	D'(5) (2.5)		a(4) −0.8	A(6) (70.0)	d'(3) 2.2
Early in June	A'(6) (5.6)	A'(7) (5.8)	b(4) 1.8	a'(5) 2.5	B(4) (2.1)	A'(3) (2.3)	a'(6) 2.9	A(7) (8.3)		A'(6) (4.0)	B(4) (2.9)	b(4) 1.5
Middle of June	c(3) 2.0	b(3) 1.9	a'(3) 0.9	A'(3) (2.6)	A'(5) (4.7)	B(3) (1.9)	b(3) 1.7	b(4) 1.9	C(2) (1.5)	a(2) 1.0	d(4) 6.0	A(4) (4.6)
Late in June	A(12) (16.3)	A(10) (12.5)	A(9) (10.0)	B(7) (5.6)	C(10) (5.0)	A(8) (10.0)	b(21) 7.0	b(10) 5.4	B(6) (3.8)	A(7) (7.3)	B(14) (9.0)	A'(8) (7.5)
Early in July	c(6) 4.0	A'(7) (6.3)	B(11) (6.5)	A'(6) (5.8)	b(5) 2.4	b(4) 1.9	A'(7) (6.2)	A(5) (9.8)	b(8) 4.3	a'(8) 3.0	a'(5) 1.2	a(8) −10.0
Middle of July	c(7) 4.0	b(8) 4.5	A(12) (15.0)	A'(10) (9.0)	C(8) (4.7)	d'(10) 6.5	A(10) (30.0)	a'(5) 1.7	d(5) 6.0	A'(10) (8.5)	a'(7) 1.8	A'(8) (7.2)
Late in July	A(12) (50.0)	A(15) (17.5)	a'(10) 2.5	a'(10) 4.3	b(6) 3.5	c(7) 5.4	b(12) 6.2	D'(12) (4.5)	A'(7) (4.8)	C(10) (5.3)	A'(8) (5.0)	a(8) −4.0
Early in Aug.	a'(6) 1.8	B(7) (5.8)	C(6) (4.4)	b(8) 4.3		B(10) (5.5)	A(10) (15.0)	B(10) (7.1)	A(7) (8.3)	A(10) (100.0)	C(10) (5.4)	A'(8) (7.0)
Middle of Aug.	B(5) (3.7)	F(6)	A(5) (5.2)	B(8) (6.0)		B(3) (2.6)	a(7) −5.0	A(4) (7.8)	A(5) (6.0)	A(6) (75.0)	B(6) (3.5)	B(4) (3.1)
Late in Aug.	b(7) 3.8	d(5) 24.0	B(5) (3.7)	a(4) −0.1	b(7) 4.8	c(4) 2.6	C(7) (3.8)	a(5) −23.8	B(5) (3.4)	C(6) (2.8)	A'(4) (3.7)	a'(5) 2.5
Early in Sept.	C(4) (2.4)	B(4) (3.3)	d'(4) 3.5	A(4) (4.2)		A(3) (3.5)	D'(5) (3.3)	A(4) (4.3)	B(3) (2.1)	F(5)	b(3) 2.0	A(3) (4.4)
Midele of Sept.	B(6) (4.0)	A(10) (10.3)	B(10) (6.3)	a'(7) 3.1	B(8) (5.5)	C(7) (3.6)	c(9) 6.0	a'(8) 3.3	C(5) (3.1)	A'(7) (6.9)	C(7) (4.2)	a(8) −10.0
A,A',a,a',(A)	6	7	6	9	3	3	8	7	3	11	5	9
B	3	3	3	2	2	3		1	3		4	3
b	2	2	1	1	3	3	3	3	2	1	3	1
C	1		2	1	2	1	1	1	2	2	2	
c	3		1	1		2	1					
D,D',d,d',(D)		1	1		1	1	2	2	1		1	2
F,f		1	1			1				1		

For legend, see Table 7.

13	14	15	16	17	18	19	20	21	22	A,A′,a,a′ (A)	B	b	C	C	D,D′,d, d′(D)	F,f
A′(12) (8.5)		C(10) (5.9)	a(13) −40.0	D(14) (−55.0)	C(12) (8.1)	B(10) (5.8)	C(13) (8.0)	a(10) 2.5	a′(10) 2.5	9	3	2	4		2	
	A(13) (20.0)	a′(13) 8.0	a′(18) 5.0		B(18) (11.0)		B(10) (8.6)	B(12) (8.7)	B(10) (8.1)	4	5	2		1	1	
a(8) −5.0		A(7) (11.0)	A(6) (7.8)	B(7) (4.8)	b(8) 4.9	c(7) 4.7	a(7) −65.0	c(6) 4.8	B(5) (3.3)	9	4	4	2	2		
b(4) 1.9		a′(4) 1.8	b(3) 1.9	B(3) (1.8)		d′(5) 3.8	a′(3) 1.4	A′(4) (3.0)	a′(3) 1.4	8	1	3		1	4	2
b(4) 1.4		a(6) −3.0	a(5) −10.0	A(4) (5.2)	A(6) (6.0)		A(5) (5.5)	a′(5) 1.5	B(6) (4.2)	13	3	3				
A′(4) (3.3)		A(4) (6.5)	A′(3) (2.4)	A(3) (3.3)	D(6) (1.0)	D(4) (−0.3)	A(5) (5.0)	C(4) (3.0)	A(3) (3.4)	11	1	3	2	1	3	
A′(7) (5.6)	A(10) (13.3)	A(10) (10.0)	a′(6) 3.4	A(17) (20.0)	A′(3) (2.5)	a′(10) 1.8	a′(10) 3.5	b(6) 3.5	a′(6) 2.2	15	3	3	1			
b(7) 2.8	B(7) (4.9)	A′(7) (4.8)	A(7) (11.8)	F(7)	a′(7) 1.8	C(7) (4.4)	f(4)	a′(4) 2.0	B(12) (7.3)	11	3	4	1	1		2
a(9) −2.0	A′(9) (8.0)	a(12) −20.0	a(8) −27.5	c(8) 4.5	a′(8) 3.0	B(7) (4.7)	A′(7) (6.1)	a′(10) 3.5	B(10) (8.2)	14	2	1	1	2	2	
a′(7) 1.9	b(12) 8.1	A(10) (11.5)	B(8) (6.0)	A(8) (12.0)	A′(12) (11.0)	b(7) 2.9	d(10) 13.5	a′(8) 3.9	A(10) (35.0)	13	1	4	1	1	2	
D′(5) (3.1)	a′(8) 2.0	A(7) (8.6)	C(7) (4.4)	C(10) (3.8)	B(9) (7.4)	B(10) (6.7)	B(10) (6.8)	B(6) (4.4)	A′(7) (5.5)	8	7	1	4		1	
a(4) −3.4	A(4) (5.0)	A′(6) (5.8)	B(11) (6.8)	A′(6) (5.3)			B(5) (4.2)	A′(5) (4.8)	A(5) (62.5)	11	7					1
a(5) −0.8	a(5) −2.3	B(5) (3.7)	a′(4) 1.9	b(4) 2.3	F(8)	c(4) 2.7	A′(7) (5.5)	B(6) (4.4)	A(5) (7.8)	9	4	3	2	2	1	1
a′(4) 2.1	B(4) (2.9)	b(5) 2.7	B(4) (3.1)	b(3) 1.9			B(3) (2.2)	B(5) (3.6)	c(3) 2.3	5	6	3	1	1	2	1
B(12) (7.5)	A(10) (14.5)	A′(8) (7.8)	a′(10) 4.5	A(13) (25.0)	A(11) (15.0)	A′(7) (6.2)	B(12) (9.4)	c(10) 7.2	A′(6) (4.0)	12	5		3	2		
9	7	12	10	6	6	2	7	7	9							
1	2	1	3	2	2	3	5	4	5							
3	1	1	1	2	1	1		1								
		1	1	1	1	1	1	1								
				1		2		2	1							
1				1	1	2	1									
				1	1		1									

7. The linear regression observable within the records by the same seiners (The records of the long shifts excluded but those of the accidental shootings included)

The preceding sections suggested a possibility of the distance of shift shortening with the amount of catch by the shooting just before the shift, in spite of the expectation of the quadratic relation. As shown in Table 9, the linear regression coefficient took the positive value in the 69 strata including the significant one in the two strata but took the negative value in the 234 strata including the significant one in the 39 strata. In regard to the seiner-by-seiner difference, the rate of the strata taking the positive coefficient seemed to differ from 0/15 (by the seiner 10) to 6/14 (by the seiner 8); but it was hard to say that the rate of the strata taking the positive linear regression coefficient significantly differed according to the seiner [$\chi_0^2 = 24.42$ with 21 degrees of freedom; $0.50 > \Pr\{\chi_0^2 > \chi^2\} > 0.25$]. And in regard to seasonal change, it was also hard to find any clear trend [$\chi_0^2 = 15.92$ with 14 degrees of freedom; $0.50 > \Pr\{\chi_0^2 > \chi^2\} > 0.25$; and $F_3 = 0.00$, $F_2 = 3.11$, and $F_1 = 0.64$; with 1 and $15 - t - 1$ degrees of freedom].

8. The linear regression observable within the records by the same seiners (The records of the long shifts included but those of the accidental shootings excluded)

The exclusion of the records of the accidental shootings and the addition of those of the long shifts made clearer the shortening trend of shift with the amount of catch yielded by the shooting just before it; the strata, which take the insignificantly negative linear regression coefficient, increased from 234 to 252, although those taking the significantly negative one decreased from 39 to 37. And those taking the significantly positive one decreased from two to one, and those taking the insignificantly positive one decreased from 67 to 51. In regard to the seiner-by-seiner difference, the rate of the strata taking the positive coefficient seemed to differ from 0/10 (by the seiner 14) to 5/14 (by the seiner 8); but it was hard to say that the rate significantly differed according to the seiner [$\chi_0^2 = 23.12$ with 21 degrees of freedom; $0.50 > \Pr\{\chi_0^2 > \chi^2\} > 0.25$]. In regard to seasonal change, the rate of the strata taking the positive coefficient seemed to differ from 0/19 (in early in June) to 6/20 (in late in April), but it was hard to find any clear trend [$\chi_0^2 = 12.19$ with 14 degrees of freedom; $0.75 > \Pr\{\chi_0^2 > \chi^2\} > 0.50$; $F_3 = 0.44$, $F_2 = 2.57$, and $F_1 = 0.00$; with 1 and $15 - i - 1$ degrees of freedom].

All the results of these examinations summarized, and it may be said that the seiner shifted over a long distance after a poor catch but she inclined to stick to the similar position after a good catch.

Discussion

Regardless of the fishing method except the pound-netting, it is very rare that the

Table 9. The estimated linear regression equations of the distance of shift (y in miles, used after the square root transformation) on the amount of catch (x in tons) by the shooting just before the shift observable within the records by the same seiners and within the 3 consecutive days in the same 10-calendar-day groups.

	Seiner No.	c_0	c_1	F_1	n	c'_0	c'_1	F'_1	n'
Late in April	1	1.97	−0.07	2.33	11	1.97	−0.07	2.33	11
	2	2.17	−0.08	0.22	8	2.17	−0.08	0.22	8
	3	1.77	−0.07	0.57	11	1.77	−0.07	0.57	11
	4	1.82	−0.06	1.13	13	1.82	−0.06	1.13	13
	5	1.90	−0.08	1.22	12	2.01	−0.10	1.04	11
	6	1.90	−0.10	3.45	12	1.64	−0.06	0.64	11
	7	1.23	0.05	0.96	10	1.55	0.02	0.08	9
	8	1.10	0.03	0.50	13	1.06	0.04	0.34	11
	10	2.14	−0.15	5.27	9	2.14	−0.15	5.27	9
	11	1.90	−0.11	1.03	9	1.90	−0.11	1.03	9
	12	2.34	−0.07	0.35	7	2.34	−0.07	0.35	7
	13	2.41	−0.11	2.50	11	2.41	−0.11	2.50	11
	14	1.11	0.08	0.97	4	–	–	–	–
	15	1.33	0.01	0.02	11	1.33	0.01	0.02	11
	16	1.84	−0.05	2.17	8	2.24	−0.09	16.20*	7
	17	0.95	0.13	14.64*	7	0.95	0.13	14.64*	7
	18	0.65	0.08	1.17	7	0.65	0.08	1.17	7
	19	1.81	−0.08	1.55	9	1.81	−0.08	1.55	9
	20	0.90	0.09	0.98	11	0.90	0.09	0.98	11
	21	2.47	−0.13	2.53	11	2.47	−0.13	2.53	11
	22	1.50	−0.03	0.34	7	1.39	−0.01	0.04	6
Early in May	1	1.81	−0.05	0.61	7	2.17	−0.08	1.90	8
	3	0.43	0.09	2.45	4	0.43	0.09	2.45	4
	7	1.36	−0.02	0.04	6	1.36	−0.02	0.04	6
	10	1.82	−0.08	0.52	8	1.82	−0.08	0.52	8
	11	1.69	−0.01	0.01	7	1.69	−0.01	0.01	7
	12	0.61	0.06	3.27	7	0.61	0.06	3.27	7
	14	1.84	−0.09	6.01	7	1.72	−0.07	1.92	6
	15	1.08	-0.00_4	0.01	5	1.08	-0.00_4	0.01	5
	16	1.18	0.01	0.13	9	1.44	−0.01	0.18	9
	19	2.15	−0.08	18.37*	5	2.15	−0.08	18.37*	5
	20	1.24	0.00_{05}	0.00_{01}	7	2.85	−0.22	3.54	7
	21	1.59	−0.03	0.15	9	1.59	−0.03	0.15	9
	22	2.32	−0.17	3.99	7	2.32	−0.17	3.99	7
Middle of May	1	3.00	−0.42	5.92*	11	3.00	−0.42	5.92*	11
	2	1.54	−0.11	1.65	12	1.54	−0.11	1.65	12
	3	1.18	0.05	0.23	7	1.18	0.05	0.23	7
	4	1.03	0.02	0.08	11	1.03	0.02	0.08	11
	5	1.92	−0.11	1.03	10	1.93	−0.12	0.61	9
	6	1.77	−0.02	0.01	7	1.77	−0.02	0.01	7
	7	2.53	−0.19	2.08	6	2.53	−0.19	2.08	6
	8	1.78	−0.08	0.07	7	1.78	−0.08	0.07	7
	9	1.90	−0.11	0.14	8	1.90	−0.11	0.14	8
	10	2.35	−0.37	3.99	12	2.35	−0.37	3.99	12

Table 9. —(Cont'd)

	Seiner No.	c_0	c_1	F_1	n	c'_0	c'_1	F'_1	n'
	11	1.29	0.06	0.09	12	1.48	−0.02	0.01	11
	12	1.17	0.09	0.39	11	1.63	−0.05	0.07	10
	13	2.16	−0.18	7.08*	10	2.16	−0.18	7.08*	10
	15	2.19	−0.26	3.60	7	2.19	−0.26	3.60	7
	16	1.83	−0.18	3.23	10	1.83	−0.18	3.23	10
	17	2.11	−0.12	0.96	11	2.11	−0.12	0.96	11
	18	2.87	−0.26	2.09	5	2.87	−0.26	2.09	5
	19	1.30	0.03	0.02	7	1.30	0.03	0.02	7
	20	2.51	−0.27	4.66	12	2.51	−0.27	4.66	12
	21	0.76	0.19	5.33*	11	0.57	0.24	3.50	10
	22	1.73	−0.07	0.76	10	1.73	−0.07	0.76	10
Late in May	1	1.45	−0.12	0.37	16	1.47	−0.12	0.31	15
	2	1.93	−0.27	3.40	20	1.90	−0.26	2.46	19
	3	1.03	−0.02	0.02	19	1.03	−0.02	0.02	19
	4	1.16	0.08	0.41	19	1.10	0.11	0.60	18
	5	0.81	0.11	1.09	18	0.81	0.11	1.09	18
	6	1.49	−0.11	0.92	17	1.27	−0.01	0.01	16
	7	1.78	−0.18	1.37	19	2.28	−0.36	2.90	16
	8	1.13	0.05	0.29	21	1.23	0.01	0.01	18
	10	1.83	−0.29	2.88	18	1.83	−0.29	2.88	18
	11	1.67	−0.12	3.96	15	1.72	−0.14	4.18	14
	12	1.12	0.16	0.60	18	1.14	0.15	0.37	17
	13	1.55	−0.23	14.21**	17	1.25	−0.10	1.66	13
	15	1.39	−0.13	3.02	18	1.36	−0.12	1.91	17
	16	1.54	−0.03	0.04	16	1.81	−0.14	0.35	12
	17	1.31	0.01	0.01	16	1.37	−0.05	0.08	14
	19	0.54	0.10	1.39	5	0.54	0.10	1.39	5
	20	1.19	−0.05	0.29	16	1.20	−0.05	0.27	15
	21	1.58	−0.12	2.85	16	1.58	−0.12	2.85	16
	22	1.93	−0.33	5.86*	16	1.71	−0.23	2.15	15
Early in June	1	1.46	−0.14	1.83	14	1.46	−0.14	1.83	14
	2	1.64	−0.14	8.58**	21	1.64	−0.14	5.49*	18
	3	1.46	−0.16	2.67	20	1.46	−0.16	2.67	20
	4	1.35	−0.03	0.14	19	1.36	−0.04	0.15	17
	5	1.62	−0.12	0.71	14	1.62	−0.12	0.71	14
	6	1.30	0.01	0.03	22	1.47	−0.06	0.40	21
	7	2.10	−0.23	7.67*	21	2;12	−0.23	4.66*	20
	8	1.16	−0.03	0.20	17	1.18	−0.03	0.19	16
	10	1.23	−0.05	1.18	18	1.11	−0.01	0.08	17
	11	1.40	−0.07	0.56	19	1.60	−0.15	1.54	17
	12	1.36	−0.12	2.23	23	1.36	−0.12	2.23	23
	13	1.52	−0.17	6.17*	17	1.40	−0.12	2.24	14
	15	1.58	−0.16	2.68	20	1.58	−0.16	2.68	20
	16	1.92	−0.15	1.36	19	1.71	−0.08	0.26	18
	17	1.81	−0.29	6.85*	20	2.21	−0.44	7.44*	17
	18	1.81	−0.13	3.53	11	1.81	−0.13	3.53	11
	20	1.20	0.01	0.00_3	19	1.42	−0.06	0.14	18
	21	1.88	−0.18	3.49	20	2.03	−0.22	4.39	19
	22	1.70	−0.18	3.22	21	1.70	−0.18	3.22	21

Table 9. — (Cont'd)

	Seiner No.	c_0	c_1	F_1	n	c'_0	c'_1	F'_1	n'
Middle of June	1	1.41	−0.19	0.54	8	1.41	−0.19	0.54	8
	2	1.54	−0.13	1.91	14	1.76	−0.18	1.01	14
	3	1.70	−0.32	3.09	21	1.70	−0.32	3.09	21
	4	1.31	−0.18	1.66	21	1.31	−0.18	1.66	21
	5	1.75	−0.30	4.25	20	1.79	−0.31	4.01	19
	6	1.13	−0.03	0.09	22	1.13	−0.03	0.09	22
	7	2.95	−0.69	6.38	7	2.95	−0.69	6.38	7
	8	1.47	−0.21	4.28	20	1.53	−0.18	1.16	21
	9	1.07	0.00_4	0.00_1	21	0.94	0.08	0.14	19
	10	1.72	−0.34	6.62*	7	1.72	−0.34	6.62*	7
	11	0.48	0.15	1.98	20	0.48	0.15	1.98	20
	12	1.77	−0.26	7.30*	18	2.01	−0.34	6.88*	18
	13	2.03	−0.41	9.76**	19	2.11	−0.44	8.99**	19
	15	1.53	−0.18	3.36	21	1.53	−0.18	3.36	21
	16	1.66	−0.21	3.59	22	1.66	−0.21	3.59	22
	17	1.55	−0.20	2.95	21	1.61	−0.24	3.28	19
	18	1.10	0.01	0.00_4	7	1.10	0.01	0.00_4	7
	19	1.00	0.09	0.53	9	1.00	0.09	0.53	9
	20	1.23	−0.09	1.99	23	1.06	−0.03	0.18	22
	21	1.30	−0.05	0.06	19	1.30	−0.05	0.06	19
	22	2.30	−0.57	38.65**	16	2.40	−0.61	40.34**	17
Late in June	1	1.68	−0.08	1.27	14	1.68	−0.08	1.27	14
	2	1.84	−0.12	4.83	12	1.84	−0.12	4.83	12
	3	1.64	−0.11	2.36	12	1.64	−0.11	2.36	12
	4	2.95	−0.37	7.86*	12	2.95	−0.37	7.86*	12
	5	1.47	0.00_{03}	0.00_{005}	11	1.47	0.00_{03}	0.00_{005}	11
	6	1.59	−0.05	1.72	13	1.65	−0.06	2.22	12
	7	1.50	−0.03	1.09	12	1.44	−0.03	0.65	11
	8	1.87	0.11	2.55	11	1.87	0.11	2.55	11
	9	1.24	−0.05	0.70	16	1.24	−0.05	0.70	16
	10	1.81	−0.11	1.82	12	1.81	−0.11	1.82	12
	11	1.41	0.02	0.11	11	1.41	0.02	0.11	11
	12	1.78	−0.10	2.05	17	1.95	−0.14	3.40	16
	13	1.91	−0.17	9.62**	17	1.91	−0.17	9.62**	17
	14	1.69	−0.05	1.06	11	1.69	−0.05	1.06	11
	15	2.07	−0.12	3.85	13	2.07	−0.12	3.85	13
	16	1.91	−0.07	0.60	7	1.68	−0.02	0.02	6
	17	2.24	−0.06	1.87	11	2.24	−0.06	1.87	11
	18	2.96	−0.21	0.06	4	2.96	−0.21	0.06	4
	19	1.95	−0.09	1.50	14	1.95	−0.09	1.50	14
	20	1.55	−0.02	0.06	11	1.55	−0.02	0.06	11
	21	1.29	0.03	0.08	10	1.77	−0.09	0.39	9
	22	1.77	−0.15	2.65	13	1.77	−0.15	2.65	13
	1	1.29	0.00_3	0.00_{02}	9	1.29	0.00_3	0.00_{02}	9
	2	1.86	−0.12	4.61*	18	1.45	−0.04	0.31	16
	3	1.78	−0.07	1.41	11	1.78	−0.07	1.41	11
	4	1.11	−0.01	0.04	10	1.28	−0.06	0.35	9
	5	1.94	−0.12	2.45	8	1.94	−0.12	2.45	8

Table 9. — (Cont'd)

	Seiner No.	c_0	c_1	F_1	n	c'_0	c'_1	F'_1	n'
Early in July	6	1.88	−0.17	1.19	16	1.88	−0.17	0.70	15
	7	1.95	−0.12	4.03	19	1.95	−0.12	4.03	19
	8	1.97	−0.28	3.01	17	1.97	−0.28	3.01	17
	9	1.34	−0.02	0.17	15	1.34	−0.02	0.17	15
	10	2.02	−0.13	1.34	14	2.02	−0.13	1.34	14
	11	2.03	−0.18	2.34	15	2.03	−0.18	2.34	15
	12	1.64	−0.08	0.65	15	1.64	−0.08	0.65	15
	13	1.65	−0.06	0.68	15	1.65	−0.06	0.68	15
	14	1.74	−0.11	3.64	17	1.71	−0.10	2.41	16
	15	1.85	−0.07	0.80	16	1.87	−0.09	1.06	15
	16	2.48	−0.30	9.77*	9	2.48	−0.30	9.77*	9
	17	1.68	−0.05	0.25	16	1.68	−0.05	0.25	16
	18	1.72	−0.13	1.49	13	1.72	−0.13	1.49	13
	19	1.44	0.06	0.17	8	1.78	-0.00_2	0.00_{01}	7
	20	1.63	0.00_4	0.00_1	10	1.63	0.00_4	0.00_1	10
	21	1.59	−0.07	0.25	12	1.59	−0.07	0.25	12
	22	1.76	−0.08	1.00	10	1.76	−0.08	1.00	10
Middle of July	1	1.12	0.07	0.77	10	1.35	0.02	0.02	11
	2	2.64	−0.19	2.78	11	2.82	−0.22	4.74	12
	3	1.65	−0.05	1.17	11	1.88	−0.08	2.69	12
	4	2.17	−0.18	6.67*	10	2.15	−0.17	7.58*	11
	5	–	–	–	–	0.28	0.16	4.49	4
	6	1.73	−0.04	0.19	10	1.74	−0.04	0.20	11
	7	1.94	0.11	2.10	10	2.17	−0.15	2.81	10
	8	1.37	−0.01	0.00_5	10	1.97	−0.15	0.52	12
	9	0.53	0.19	4.19	15	1.24	0.03	0.06	16
	10	1.39	−0.04	0.34	9	2.64	−0.19	4.63	12
	11	1.44	−0.07	0.43	10	1.93	−0.16	2.27	11
	12	2.39	−0.16	7.54*	13	2.36	−0.16	8.42*	14
	13	2.10	−0.10	1.08	9	2.10	−0.10	1.08	9
	14	2.30	−0.19	8.36*	10	2.57	−0.23	10.95**	11
	15	1.88	−0.06	1.17	11	2.14	−0.11	2.59	11
	16	1.78	−0.09	1.79	13	2.08	−0.13	1.67	14
	17	1.49	−0.02	0.10	15	1.41	−0.01	0.01	16
	18	4.00	−0.35	67.56*	4	4.00	−0.35	67.56*	4
	19	1.33	−0.05	0.19	6	1.33	−0.05	0.19	6
	20	1.22	0.00_1	0.00_{01}	11	2.15	−0.19	2.79	11
	21	1.57	−0.02	0.33	11	1.74	−0.05	1.00	11
	22	1.59	−0.10	4.04	9	2.11	−0.17	2.52	10
	1	1.75	−0.08	1.90	14	1.75	−0.08	1.90	14
	2	2.18	−0.12	8.68*	14	2.18	−0.12	8.68*	14
	3	1.64	−0.05	0.72	15	1.64	−0.05	0.72	15
	4	1.79	−0.08	3.34	13	1.94	−0.09	1.09	13
	5	–	–	–	–	2.84	−0.25	0.62	4
	6	1.38	−0.02	0.04	14	1.38	−0.02	0.04	14
	7	1.27	−0.01	0.04	11	1.36	0.00_1	0.00_{03}	12
	8	1.25	0.01	0.03	13	1.25	0.01	0.03	13
	9	1.49	−0.06	1.98	15	1.49	−0.06	1.98	15
	10	1.95	−0.16	8.91*	13	1.46	−0.04	0.43	14

Table 9. — (Cont'd)

	Seiner No.	c_0	c_1	F_1	n	c'_0	c'_1	F'_1	n'
Late in July	11	1.42	0.00_2	0.00_{04}	12	1.42	0.00_2	0.00_{04}	12
	12	1.89	−0.05	0.27	10	3.00	−0.23	5.21	9
	13	2.02	−0.15	2.42	14	2.02	−0.15	2.42	14
	14	1.75	−0.12	6.91*	10	1.52	−0.03	0.09	12
	15	1.66	−0.08	3.25	13	2.10	−0.13	7.75*	13
	16	1.53	0.00_{03}	0.00_{002}	14	1.73	−0.04	0.15	13
	17	1.47	−0.06	1.98	13	2.10	−0.16	12.80**	11
	18	1.15	−0.02	0.25	7	1.15	−0.02	0.25	7
	19	1.72	−0.10	0.97	6	1.72	−0.10	0.97	6
	20	1.09	0.02	0.12	11	0.63	0.08	1.19	10
	21	1.72	−0.08	0.53	11	1.80	−0.08	0.50	12
	22	1.71	−0.06	1.21	14	1.71	−0.06	1.21	14
Early in Aug.	1	1.68	−0.07	0.98	13	2.15	−0.16	2.16	12
	2	1.10	0.02	0.03	10	3.44	−0.38	7.21*	11
	3	1.08	0.01	0.00_3	8	1.08	0.01	0.00_3	8
	4	1.98	−0.11	0.87	12	1.98	−0.11	0.87	12
	6	1.47	0.03	0.15	13	1.92	−0.03	0.12	15
	7	1.43	−0.05	0.34	13	2.03	−0.14	1.66	13
	8	1.48	0.01	0.00_3	12	1.48	0.01	0.00_3	12
	9	1.86	−0.11	1.28	11	2.58	−0.24	3.11	11
	10	1.84	−0.06	0.73	14	1.84	−0.06	0.73	14
	11	1.16	0.06	0.41	11	1.24	0.06	0.40	12
	12	2.88	−0.26	8.08*	11	2.88	−0.26	8.08*	11
	13	1.06	0.16	1.22	11	1.42	0.08	0.30	12
	14	1.66	−0.07	0.90	13	1.82	−0.10	1.67	14
	15	1.13	−0.01	0.01	9	3.40	−0.35	4.65	10
	16	1.23	0.05	0.14	12	1.77	−0.07	0.19	13
	17	1.30	0.06	1.22	14	1.42	0.06	0.38	12
	18	2.09	−0.13	1.31	12	2.09	−0.13	1.31	12
	19	1.67	−0.07	1.00	14	1.67	−0.07	1.00	14
	20	1.66	−0.05	0.33	13	1.98	−0.10	0.78	13
	21	0.68	0.20	0.35	11	2.41	−0.14	0.61	12
	22	1.71	−0.11	3.15	12	1.71	−0.11	3.15	12
Middle of Aug.	1	1.77	−0.12	1.21	18	2.23	−0.25	3.51	16
	2	1.29	0.00_5	0.00_4	17	1.29	0.00_5	0.00_4	17
	3	1.85	−0.17	1.54	11	1.85	−0.17	1.54	11
	4	1.56	−0.11	3.44	17	1.73	−0.15	5.73*	16
	6	1.82	−0.14	1.27	16	1.90	−0.17	1.66	15
	7	1.91	−0.16	2.02	17	1.91	−0.16	2.02	17
	8	2.12	−0.31	6.05*	13	2.12	−0.31	6.05*	13
	9	1.58	−0.17	5.05*	17	1.58	−0.17	5.05*	17
	10	1.71	−0.15	7.44*	17	1.71	−0.15	7.44*	17
	11	1.17	−0.03	0.19	18	1.17	−0.03	0.19	18
	12	2.72	−0.53	4.52	15	2.72	−0.53	4.52	15
	13	2.66	−0.48	14.04**	15	2.66	−0.48	14.04**	15
	14	2.24	−0.35	17.43**	18	2.37	−0.39	14.96**	17
	15	1.58	−0.08	1.19	15	1.63	−0.09	0.88	13
	16	1.85	−0.05	0.41	15	2.10	−0.10	1.42	14

Table 9. —(Cont'd)

	Seiner No.	c_0	c_1	F_1	n	c'_0	c'_1	F'_1	n'
	17	1.69	−0.09	1.39	17	1.69	−0.09	1.39	17
	20	1.95	−0.22	3.92	18	2.06	−0.24	4.81*	17
	21	2.26	−0.33	7.22*	14	2.55	−0.40	14.52**	13
	22	2.09	−0.20	2.04	18	2.21	−0.24	1.57	17
Late in Aug.	1	1.10	−0.01	0.10	20	1.17	−0.03	0.40	20
	2	1.12	0.08	0.40	16	0.31	0.39	2.10	18
	3	1.08	−0.02	0.03	16	1.10	−0.02	0.03	15
	4	2.01	−0.35	7.94*	13	2.16	−0.38	4.40	13
	5	1.07	−0.06	1.02	6	1.07	−0.06	1.02	6
	6	1.22	0.09	1.01	15	1.69	−0.04	0.06	14
	7	1.12	0.04	0.32	17	1.49	−0.06	0.56	18
	8	1.49	−0.09	1.23	16	1.99	−0.21	3.03	16
	9	1.06	−0.01	0.07	15	1.30	−0.09	1.09	12
	10	1.94	−0.14	1.30	15	1.39	0.10	0.34	16
	11	1.71	−0.20	2.63	15	2.18	−0.34	7.68*	17
	12	1.23	−0.02	0.02	16	1.23	−0.02	0.02	16
	13	2.12	−0.25	13.96**	18	2.34	−0.31	26.84**	17
	14	1.63	−0.18	4.56	16	1.83	−0.21	4.24	17
	15	1.46	−0.10	1.01	17	2.07	−0.27	3.21	18
	16	1.63	−0.18	1.27	15	1.63	−0.18	1.27	15
	17	1.57	−0.10	1.64	18	1.64	−0.08	0.21	16
	18	1.14	−0.04	0.59	6	0.69	0.04	1.13	5
	19	1.79	−0.19	2.44	8	1.56	0.01	0.00_2	10
	20	1.69	−0.13	5.09*	18	2.01	−0.19	5.74*	19
	21	1.02	0.03	0.10	13	1.78	−0.13	1.02	14
	22	1.94	−0.19	3.87	19	1.94	−0.19	3.87	19
Early in Sept.	1	1.21	0.01	0.02	9	1.21	0.01	0.02	9
	2	1.62	−0.17	2.41	9	2.96	−0.57	7.76*	9
	3	0.33	0.21	1.05	9	0.33	0.21	1.05	9
	4	1.71	−0.25	5.74*	10	1.92	−0.32	4.65	9
	6	1.62	−0.17	2.67	9	1.62	−0.17	2.67	9
	7	0.81	0.13	0.41	8	0.81	0.13	0.41	8
	8	1.50	−0.15	0.92	6	1.50	−0.15	0.92	6
	9	1.73	−0.18	0.26	8	1.64	−0.13	0.04	7
	10	1.23	−0.04	0.04	10	1.23	−0.04	0.04	10
	11	1.05	−0.08	0.00_3	10	1.05	−0.08	0.00_3	10
	12	1.69	−0.22	1.21	9	1.69	−0.22	1.21	9
	13	1.46	−0.07	0.16	9	1.46	−0.07	0.16	9
	14	1.38	−0.07	0.24	6	1.38	−0.07	0.24	6
	15	1.67	−0.09	0.67	9	1.52	−0.05	0.09	8
	16	1.67	−0.09	0.08	6	2.83	−0.47	3.02	7
	17	1.44	−0.05	0.09	8	1.93	−0.22	1.36	7
	20	1.73	−0.14	0.77	10	1.73	−0.14	0.77	10
	21	1.80	−0.21	0.78	8	1.80	−0.21	0.78	8
	22	1.20	0.12	0.22	9	1.20	0.12	0.22	9
	1	2.31	−0.13	1.06	7	2.31	−0.13	0.43	6
	2	1.94	−0.12	2.31	14	2.32	−0.19	3.39	13

Table 9. — (Cont'd)

	Seiner No.	c_0	c_1	F_0	n	c'_0	c'_1	F'_0	n'
Middle of Sept.	3	0.98	0.02	0.05	10	1.98	−0.12	0.95	11
	4	1.18	−0.05	0.75	12	1.82	−0.17	2.65	10
	5	1.58	−0.06	1.74	13	1.78	−0.10	3.93	12
	6	0.92	0.05	0.49	11	0.92	0.05	0.49	11
	7	1.24	−0.06	0.70	13	0.63	0.05	0.30	12
	8	1.21	0.01	0.02	14	1.38	−0.02	0.06	15
	9	0.42	0.18	1.13	8	0.42	0.18	1.13	8
	10	1.70	−0.12	4.41	11	1.70	−0.12	4.41	11
	11	0.86	0.09	0.98	12	0.31	0.20	1.47	9
	12	2.20	−0.18	14.22**	10	1.68	−0.09	2.10	9
	13	1.35	−0.01	0.02	15	1.49	−0.03	0.16	13
	14	1.93	−0.20	38.17**	11	1.93	−0.20	38.17**	11
	15	2.32	−0.21	11.85**	11	1.94	−0.15	2.87	10
	16	1.65	0.04	2.36	15	1.65	0.04	2.36	15
	17	1.38	−0.05	7.22*	12	1.49	−0.06	9.08*	11
	18	1.39	−0.04	1.17	15	1.44	−0.05	0.82	14
	19	1.35	−0.06	1.77	14	1.41	−0.07	0.81	13
	20	1.26	-0.00_5	0.00_3	10	2.11	−0.11	1.10	10
	21	1.25	0.00_3	0.00_3	9	1.61	−0.03	0.14	9
	22	1.31	−0.05	0.47	11	1.31	−0.05	0.47	11

$y = c_0 + c_1 x$ or $y = c'_1 + c'_1 x$

The records of the accidental shootings included but those of the long shifts excluded

The records of the accidental shootings excluded but those of the long shifts included

Note: n or n' .... The sample size
F_1 .... The estimated Snedecor's F value for c_1 with 1 and $n - 2$ degrees of freedom
F'_1 .... That for c'_1 with 1 and $n' - 2$ degrees of freedom
* Significant at 0.05 level ** Significant at 0.01 level

Table 10. The seiner-by-seiner difference of the coefficient in the regression lines.

1) The records of the accidental shootings included but those of the long shifts excluded

		Seiner No.																						Sum
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
c_1	+																	1				1		2
	(+)	3	3	5	2	2	4	4	6	3		6	3	1	1	1	4	2	2	4	6	4	1	67
	(−)	11	8	10	8	7	10	10	7	7	12	9	8	6	6	13	10	9	8	7	8	9	12	195
	−	1	3		4			1	1	1	3		4	7	4	1	1	2	1	1	1	1	2	39
Sum		15	14	15	14	9	14	15	14	11	15	15	15	14	11	15	15	14	11	12	15	15	15	303

2) The records of the accidental shootings excluded but those of the long shifts included

c'_1	+																	1						1
	(+)	3	2	4	2	3	1	4	5	3	1	5	2	1		1	1	1	3	4	3	1	1	51
	(−)	11	8	11	9	8	13	10	8	7	12	9	10	8	7	13	12	9	7	7	10	13	13	215
	−	1	4		3			1	1	1	2	1	3	5	3	1	2	3	1	1	2	1	1	37
Sum		15	14	15	14	11	14	15	14	11	15	15	15	14	10	15	15	14	11	12	15	15	15	304

Table 11. The seasonal change of the coefficient in the regression lines.

1) The records of the accidental shootings included but those of the long shifts excluded

		April	May			June			July			Aug.			Sept.		Sum
		l	e	m	l	e	m	l	e	m	l	e	m	l	e	m	
	+	1		1													2
c_1	(+)	6	4	5	6	2	4	4	3	4	4	9	1	4	4	7	67
	(-)	14	8	13	11	13	13	16	17	13	14	11	12	15	14	11	195
	–		1	2	2	4	4	2	2	4	3	1	6	3	1	4	39
Sum		21	13	21	19	19	21	22	22	21	21	21	19	22	19	22	303

2) The records of the accidental shootings excluded but those of the long shifts included

		April	May			June			July			Aug.			Sept.		Sum
	+	1															1
c'_1	(+)	5	2	4	5		4	3	2	3	4	5	1	4	4	5	51
	(-)	13	10	15	14	16	13	17	19	15	15	14	10	15	14	15	215
	–	1	1	2		3	4	2	1	4	3	2	8	3	1	2	37
Sum		20	13	21	19	19	21	22	22	22	22	21	19	22	19	22	304

fishing boat sticks to the same position throughout the consecutive work. In some of the fishing methods, for example in the hand-lining for the reef fish, the favorable points for fishing are limited; but these methods are not the exception but the boat for them also shifts around some of the favorable positions during the working time. Before the popularization of the wireless telephone and echo-sounder, the skipper shifted to the probable position basing on his experience; but, nowadays, abundant informations are available through the frequent intercommunication to the fellow boats by wireless telephone. And he can settle his fishing position basing on not only these informations but also the results of the direct scouting for the objective school through echo-sounder. The workable time shared for the shift increased and the choice of the fishing points became far more rational than before the popularization of these devices. These facts caused the increasing necessity of clarifying the relation between the distance of shift and the amount of catch yielded by the shooting either just before or after the shift. In the preceding report were treated the catch-shift-catch relations observable in the catch records by the Danish seiners during the fleet-type Alaska pollack fishing in the Eastern Bering Sea, but it was hard to find any other results than that the trend of yielding a good catch by the shooting either after that yielding a good catch or after a long shift. This difficulty may be due to the fact that the amount of catch is affected by many factors. But there remained a possibility of finding out some clear results when the relation of the other factors to the amount of catch was examined adopting the latter as the independent variable. For the purpose of finding out a clue to solve the mechanism of how to decide the location of shooting the net, accordingly, the relation of the distance of shift to the amount of catch by the shooting just before the shift was examined; and it was found out as one of the trends observable regardless of the season and common to all the seiner that the seiner inclined to shift over a long distance after the shooting of poor catch but stay within a short range after a good catch. This finding was supported not only by the staff of the fleet but also by the skippers as one of the most easily conceivable facts. And it may be said that the wireless telephone on the fishing boat was used as one of the most effective devices in supplying frequently the informations and the skippers of the fleet-type operation accept the informations frankly.

The shortening of shift in accordance with the amount of catch was a general trend. And the linear regression coefficient took the negative value in the 242 strata out of the 303 ones, but took the significantly negative one only in the 37 strata. The most probable reasons why the significantly negative values are seledom taken, were the daily rhythmic change of the behavior of the objective fish, the necessity of transshipping the catch, the distribution of the fellow seiners, and the location of the factory ship. The objective fish, Alaska pollack, shows a clear daily rhythmic change of the behavior — living near the sea floor in the daytime but floating up at night. The possibility of yielding a good catch differs hourly—high about at noon, and the evaluation of a certain amount of catch differs also hourly. Early in the morning, the seiner did not sail over a long distance however low the catch may be, for she had not sufficient informations from the fellow seiners and the possibility of yielding a good catch was low. In the morning, the seiner sailed over a long distance for scouting, for the schools began to be settled on or near the sea floor, the possibility of yielding a good catch was increasing but still not high enough, and the seiner received many informations. About at noon, the seiner did not spend many fishable hours for scouting but repeated frequent shootings. And near the sunset, the seiner did not sail over a long distance for scouting, for the remaining workable hour was short and the possibility of yielding a good catch after a long scouting was low. The above-mentioned work pattern made the catch-shift relation rough. The catch was abundant when compared with the capacity of fish hold. And the seiner had to transship the catch at least every two days. When the fish hold was almost empty, the seiner could shift freely according to the informations from the fellow seiners; but when the hold had not sufficient space to load the additional catch, the seiner had to shift shooting by shooting towards the factory ship or had to wait the approaching factory ship repeating a few shootings around the assigned position. When the carry over of the material fish on the factory ship was not sufficient, the seiners with much material fish were called back the factory ship, and they had to shift towards the factory ship. In either of the cases, the distance of shift for transshipping had no relation to the amount of catch just before the shift, and the distance of shift after the transshipping depended mainly on the remaining workable hours. And also it is natural that the seiners working in the fleet type operation can not choose freely the location of shooting the net. These facts made the shortening trend rough or sometimes made the relation different from the general trend. But it was hard to examine the background of the records shooting by shooting, and the uncertainty in the results may be unavoidable.

Conclusion

The choice of the position of shooting the net might deeply depend on the skipper's will. But it may be concluded that the seiner inclined to shift over a long distance after the shooting of poor catch and she inclined to stick to the similar position after the shooting of good catch. This trend was not very strict because the objective fish shows daily rhythmic change of behavior and the seiner has to shift sometimes for transshipping the catch.

Summary

In accordance with the popularization of wireless telephone and echo-sounder, the time shared for the scouting work increased and the choice of the shooting location became rational. For the purpose of finding out a clue to solve the mechanism of how to decide the location of shooting the net, the working records during the entire season of 1964 by the 22 Danish seiners consisting of a fleet fished along the outer edge of the continental shelf of the Eastern Bering Sea were examined, and the following results were obtained:

1. The convex relation of the distance of shift to the amount of catch by the shooting just before the shift was found in the records on the 16 days, but the concave one was on the 28 days, but most of the quadratic regression coefficients were insignificant. This variety of the results and the insignificance of the quadratic regression were due to the bias of the catch-class at the estimated maximum (or the minimum) of the distance of shift in relation to the applicable catch range.
2. The relation within the applicable catch range and the examination on the linear regression showed that the distance of shift (in miles, after the square root transformation) decreased in accordance with the amount of catch by the shooting just before the shift, as shown by the fact that the linear regression coefficient was significantly negative in the records on the 29 days and insignificantly negative on the 12 days out of the 44 days.
3. This trend was not due to the seiner-by-seiner difference of the amount of catch and the preference of work pattern, but the similar trend was observable after the stratification of the records according to the seiner. And it was hard to find out not only the seiner-by-seiner difference and the seasonal change in respect of the shortening trend of the distance of shift in accordance with the amount of catch by the shooting just before the shift.
4. But this trend was not strict, as shown by the fact that the linear regression coefficient after the stratification of the records according to the seiner and the season (into the classes of the 10-calendar-day intervals) was negative in the 252 strata out of the 303 ones but was significant only in the 37 strata. This fact may be due to the daily

rhythmic change of the behavior pattern of the objective fish, the necessity of transshipping the catch, the distribution of the fellow seiners, and the location of the factory ship.

Reference

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