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Further investigations on the effect of wind on catches

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INTRODUCTION.

Some investigations on the effect of wind on catches have in recent years already been carried out.

Harden Jones, Scholes and Cheeseman (1969) made a preliminary analysis of the apparent relationship between wind direction and catch of a Lowestoft trawler, the "Willa", operating near the British coast.

de Veen (1969) studied the effect of the wind direction on the catches of a trawler, the UK81, using an otter trawl and operating near the Dutch coast.

Hovart en Vanden Broucke (1970) made a first approach on the effect of wind on catches on Icelandic grounds.

Scholes and Urquhart (1970) gave a description of the skippers' log sheets and data input forms for computer processing.

In Belgium, research on the effect of the wind on catches was continued. Log sheets were distributed among fishermen. These sheets mention haul by haul : date, fishing ground, Decca position at the beginning and

at the end of the haul, depth, time of shooting and hauling, direction of tide and tow, state of the sea, wind direction and force, swell, barometric pressure, visibility, total catch and composition of the catch (see appendix).

The data obtained from the log sheets during the period march 1970 - may 1971 were analysed and the results are given in this paper.

MATERIAL and METHODS.

The analysis was carried out on 885 hauls made by two beam trawlers (i.e. 560 by trawler 1 and 325 by trawler 2). Hauls with damage to gear were eliminated.

The main characteristics of the trawlers are given in table 1. Beam nets of 6 m were used. The groundropes had a length of about 9,5 m and were equipped with tickler chains. The material of the nets was polyamide yarn. The mesh opening was in the first two net parts 80 mm and in the third one and in the codend 75 mm. The taper ratio of the first net part was 1/1, of the second and the third part 1/3 and of the codend 0/1.

Two areas were operated upon. Figure 1 shows the distribution of the hauls over both areas.

The duration of the hauls varied between ½ and 3 ½ hours, with a mean of 2 hours.

The catches were estimated by the skipper (in baskets of 50 kg) and a comparison between the estimations and the landings showed a deviation of about 10 %.

The composition of the catch was determined for every haul ; the catches consisted mainly of sole and plaice, so much so that for both species

the relation between wind force, wind direction and catch could be examined. For area 1 the composition of the catches was 46.5 % sole and 51.7 % plaice whereas for area 2 the proportion was 61.6 % sole and 36.0 % plaice.

Wind directions were grouped as in previous studies (Harden Jones, Scholes and Cheeseman, 1969) : 1. north to north-east, 2 : north-east to east, 3 : east to south-east, 4 : south-east to south, 5 : south to south-west, 6 : south-west to west, 7 : west to north-west and 8 : north-west to north.

Wind strength was estimated by the skipper according to the Beaufort scale.

For each haul the catch per hour fishing was calculated. The data were normalized (log catch/hour fishing) and analysis of variance was applied.

A modified Duncan-test was used to determine significant differences between the mean log catch/hour fishing per wind strength or wind direction.

RESULTS and DISCUSSION.

1. Tables 2 and 3 group the mean log catch/hour fishing data according to wind force. Table 4 gives the wind forces in descending order of mean log catch/hour fishing. The wind forces related to catches which were not significantly different (5 %), are joined by a line.

   In area 1 sole catches higher than the mean are obtained with wind forces 1, 2 and 3. The plaice catches are larger with wind forces 6, 3, 2 and 1. For the two species, only the lowest catches, with wind force 7, differ significantly from the catches obtained at other wind forces.

   In area 2 the analysis of variance showed no significant results.

2. Tables 5 and 6 mention the mean log catch/hour fishing data according to wind directions for all wind forces. Table 7 presents the wind direction in descending order of mean log catch/hour fishing.

In area 1 the sole catches are significantly larger with winds blowing from southerly to south-westerly directions (sector 5) than for the other directions. The plaice catches with winds blowing from south to south-west and from north to north-east (sectors 5 and 1) differ significantly from the catches for other wind directions. However, the difference between the catches in sector 5 and in sector 1 is not significant.

In area 2 the best sole catches are obtained with northern winds (sectors 8 and 1). These catches do not differ significantly from each other, but they are significantly different from catches made when the wind was blowing from other directions.

The best plaice catches are also obtained in windsector 8 and 1 as well as with south-eastern to southern winds (sector 4). These catches do not differ significantly from each other. Only the catches with winds blowing from sector 8 differ significantly from the catches with winds blowing from all other sectors.

3. Tables 8 and 9 give the mean log catch/hour fishing data according to the wind direction for wind strengths below and above 4 Beaufort. Table 10 groups the wind directions in descending order of mean log catch/hour fishing.

For wind strengths lower than 4, in area 1, the best sole catches appear with winds blowing between south and south-west (sector 5). These catches differ significantly from those from other directions.

The best plaice catches are obtained with north to north-eastern and south to south-western winds (sectors 1 and 5). The differences between the catches of these two directions are not significant. They are however when comparing them with the results found in all other sectors.

For wind strengths above 4 Beaufort only the analysis of variance for sole is significant. The best catches are booked with winds blowing between east and south (sectors 3 and 4) and between north-west and north (sector 8). The differences between these catches are not significant. Only the catches from sector 4 differ significantly from those of the other sectors. Although plaice gives no significant results, the sectors 4, 8 and 3 present the best catches for wind strengths above 4 Beaufort.

In area 2 for wind forces below 4, the best sole catches are noted for northern winds (sectors 8 and 1). These catches do not differ significantly from each other, but they are significantly different from catches obtained from other directions.

As regards plaice the best catches appear with winds blowing from sector 8, but the difference with the catches for other directions is only slightly pronounced.

For wind strengths above 4 Beaufort the best sole catches are obtained once again with northern winds (sectors 8 and 1) and these catches do not differ significantly from each other.

Although the analysis of the plaice catches does not give significant results, the sectors 1 and 8, besides sector 4, present the best catches.

The preceding results may be summarized as follows :

1) In area 1 the best sole catches were made with wind forces 1, 2 and 3. The best plaice catches were also obtained with wind forces 1, 2 and 3 as well as with wind force 6. Only the catches with wind force 7, the lowest, differ significantly from those for other wind forces.

   No significant results were noted in area 2.

2) In area 1 the best sole catches were registered with wind directions between south and south-west whereas the best plaice catches were obtained with wind directions between south and south-west and between north and north-east.

   Area 2 presented the best sole catches with northern winds. The same occured with plaice, however, winds between south and south-east also yielded good catches.

3) For wind forces below 4, the best sole catches were noted with south to south-west winds in area 1. Good plaice catches were also obtained with these directions as well as with north to north-east winds.

   In area 2 the best sole catches were obtained with northern winds. Wind directions between north-west and north yielded the best plaice catches.

4) For wind forces above 4, the best sole catches were noted in area 1 with winds blowing between east and south and with wind directions between north-west and north. No significant results were obtained for plaice catches.

   In area 2 the best sole catches were once more noted with northern winds whereas the analysis of variance on plaice was not significant.

According to Harden Jones et al. (1969) the catches were highest with south-east to south winds (sector 4) regardless the wind strengths.

For wind forces below 4 Beaufort, the highest catches were noted with wind directions between south and south-west (sector 5), whereas for wind forces above 4, the catches were highest with winds blowing from south-east to south (sector 4).

The poorest catches were always recorded with northern winds.

The analysis per species showed that the best plaice catches appeared with winds from sector 4 and 5.

According to de Veen (1969) the catches increased up to strengths of 3 Beaufort ; higher wind strengths resulted in decreasing catches. This seemed to be the case for plaice, sole and dab. Whiting followed an identical pattern, however, at force 6 the catches showed a marked increase.

The analysis of the data according to the wind direction showed that for plaice, whiting and sole the highest catches were made with south-eastern to south-western winds. The plaice catches also showed a peak with northern-north-eastern wind direction, the sole catches with north-western-northern direction. The poorest plaice, whiting and dab catches were recorded with western-north-western and north-western-northern winds. Winds from north-east to east yielded the best dab catches.

The analysis for the years 1959 and 1960 taken separately gave identical results for plaice, whiting and dab. The results for sole however were different.

Comparing these results it becomes apparent that the effect of the wind on the catches differs from area to area and from species to species. Walden and Schubert (1965) also mention this phenomenon.

The relation wind-catch is furthermore probably dependent on the type of fishing gear.

The whole of these observations raises many questions, which can only be solved by carrying out a study on a larger amount of data and by a closer collaboration with other countries.

Factors as fish behaviour, hydrografic conditions and their effect on the state of the water (turbidity, swell) as well as the behaviour of gear and ship may play an important role which may perhaps be determined in the manner mentioned in the previous paragraph.

SUMMARY.

1. The effect of wind force and wind direction on catches of Belgian beamtrawlers has been studied for sole and plaice in two different areas.

2. The explanation of the effect of wind on catches leaves many questions unanswered. These suppose further joint investigations.

REFERENCES.

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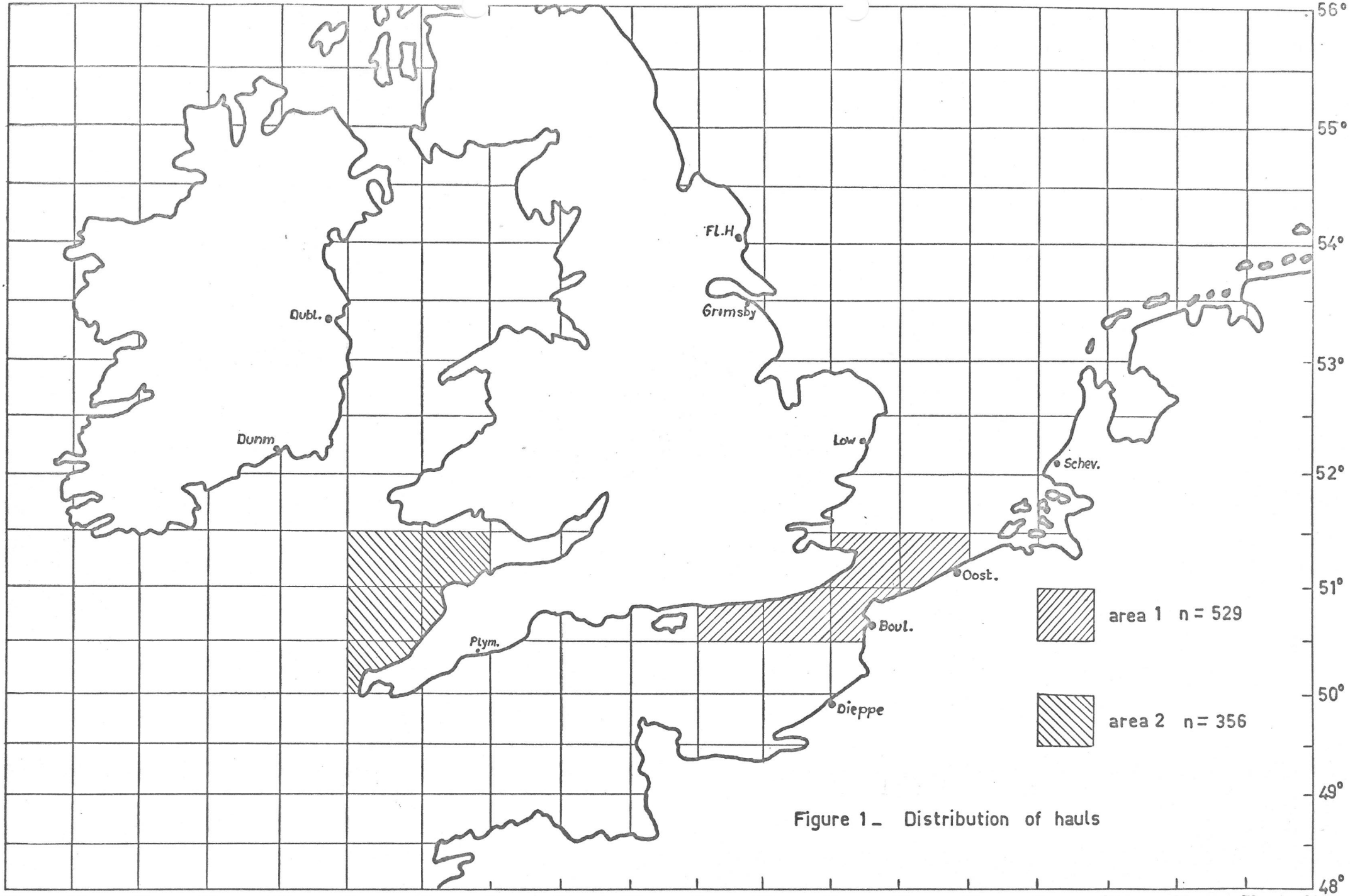

Figure 1 – Distribution of hauls

STRIKT VERTROUWELIJK

Vaartuig :

Schipper : Vistuig : nr blad :

Datum van vertrek : Datum van terugkeer in de haven :

Datum	Visgrond	Nr. Sleep	Decca posities		Diepte	Sleep		Richting		Weersomstandigheden							Vangsten in bennen van kg						Opmerkingen
			Begin sleep	Einde sleep		Begin	Einde	Getij	Sleep	Toestand zee	Wind-richting	Wind-kracht	Deining		Baro-meter-stand	Zicht-baar-heid	Totaal	Tong	Schol	Kabel-jauw	Schel-vis	Wijting	
													Toestand	Richting									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Table 1 - Characteristics of the trawlers.

	Trawler 1	Trawler 2
Date of construction	1956	1966
Hull	steel	steel
Gross tonnage	79.84	97.40
Engine power	300 bhp	282 bhp
Overall length	26.25 m	21.99 m

Table 2 - Sole catches in relation to the wind strength
(S = significant $p < 0.01$; s = significant $p < 0.05$)

Wind strength	Area 1			Area 2		
	Number of hauls	Catch/ hour(kg)	Mean log (catch/hour)	Number of hauls	Catch/ hour(kg)	Mean log (catch/hour)
1	107	15.4	1.1874	77	11.3	1.0518
2	159	14.1	1.1486	97	9.5	0.9783
3	114	14.5	1.1626	76	10.6	1.0250
4	68	13.0	1.1134	58	10.8	1.0333
5	62	11.0	1.0399	29	11.5	1.0592
6	14	10.4	1.0164	10	12.0	1.0774
7	5	6.3	0.8017	9	14.0	1.1447
Total	529			356		
Mean		13.7	1.1355		10.6	1.0268
F			3.8775(S)			0.8445

Table 3 - Plaice catches in relation to the wind strength
(S = significant $p < 0.01$; s = significant $p < 0.05$)

Wind strength	Area 1			Area 2		
	Number of hauls	Catch/ hour(kg)	Mean log (catch/hour)	Number of hauls	Catch/ hour (kg)	Mean log (catch/hour)
1	107	13.5	1.1298	77	7.5	0.8721
2	159	14.0	1.1470	97	6.3	0.7978
3	114	15.1	1.1778	76	6.4	0.8043
4	68	11.1	1.0454	58	5.9	0.7687
5	62	9.6	0.9832	29	4.7	0.6692
6	14	16.7	1.2222	10	6.6	0.8184
7	5	6.7	0.8236	9	5.4	0.7308
Total	529			356		
Mean		13.1	1.1169		6.3	0.7990
F			2.3161(s)			1.6592

Table 4 - Wind strengths in descending order of mean log (catch/hour fishing)

	Sole	Plaice
Area 1	1 3 2 4 5 6 7	6 3 2 1 4 5 7
Area 2	7 6 5 1 4 3 2	1 6 3 2 4 7 5

Table 5 - Sole catches in relation to the wind direction
(S = significant $p < 0.01$; s = significant $p < 0.05$)

Wind sector	Area 1			Area 2		
	Number of hauls	Catch/ hour(kg)	Mean log (catch/hour)	Number of hauls	Catch/ hour(kg)	Mean log (catch/hour)
1	14	14.7	1.1665	46	12.6	1.1001
2	109	11.7	1.0697	28	7.7	0.8840
3	40	19.0	1.2776	13	6.2	0.7956
4	49	15.3	1.1849	14	6.1	0.7818
5	23	25.8	1.4116	-	-	-
6	206	13.2	1.1219	43	8.4	0.9222
7	47	10.1	1.0038	38	8.2	0.9154
8	41	15.1	1.1780	174	13.2	1.1216
Total	529			356		
Mean		13.7	1.1364		10.7	1.0288
F			8.2630(S)			10.6110(S)

Table 6 - Plaice catches in relation to the wind direction
(S = significant $p < 0.01$; s = significant $p < 0.05$)

Wind sector	Area 1			Area 2		
	Number of hauls	Catch/ hour(kg)	Mean log (catch/hour)	Number of hauls	Catch/ hour(kg)	Mean log (catch/hour)
1	14	29.7	1.4722	46	6.0	0.7785
2	109	8.8	0.9446	28	4.8	0.6787
3	40	17.9	1.2523	13	4.8	0.6855
4	49	8.9	0.9483	14	6.4	0.8033
5	23	31.2	1.4935	-	-	-
6	206	14.0	1.1458	43	4.2	0.6250
7	47	10.0	1.0018	38	5.3	0.7239
8	41	18.7	1.2723	174	7.7	0.8888
Total	529			356		
Mean		13.0	1.1149		6.3	0.7978
F			10.2182(S)			6.2637(S)

Table 7 - Wind directions in descending order of mean log (catch/hour fishing)

	Sole	Plaice
Area 1	5 3 4 8 1 6 2 7	5 1 8 3 6 7 4 2
Area 2	8 1 6 7 2 3 4	8 4 1 7 3 2 6

Table 8 - Sole catches in relation to the wind direction at wind strengths below and above force 4
(S = significant $p < 0.01$) ; s = significant $p < 0.05$)

Wind sector	Area 1						Area 2					
	Winds below 4			Winds of force 4 and above			Winds below 4			Winds of force 4 and above		
	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)
1	11	17.2	1.2362	3	8.1	0.9108	36	12.1	1.0837	10	14.4	1.1593
2	56	11.6	1.0657	53	11.9	1.0739	23	7.8	0.8917	5	7.1	0.8486
3	35	19.1	1.2800	5	18.2	1.2604	12	6.3	0.7970	1	6.0	0.7782
4	42	14.2	1.1511	7	24.4	1.3877	11	6.0	0.7782	3	6.2	0.7951
5	23	25.8	1.4116	-	-	-	-	-	-	-	-	-
6	150	14.4	1.1577	56	10.6	1.0236	26	8.4	0.9237	17	8.3	0.9200
7	24	9.8	0.9899	23	10.6	1.0247	12	6.7	0.8277	26	9.0	0.9559
8	39	14.9	1.1743	2	17.7	1.2491	130	12.4	1.0945	44	15.9	1.2016
Total	380			149			250			106		
Mean		14.6	1.1635		11.6	1.0639		10.4	1.0156		11.5	1.0601
F			7.3624 (S)			2.3384 (s)			6.0056 (S)			7.3907 (S)

Table 9 - Plaice catches in relation to the wind direction at wind strengths below and above force 4
(S = significant $p < 0.01$; s = significant $p < 0.05$)

Wind sector	Area 1						Area 2					
	Winds below 4			Winds of force 4 and above			Winds below 4			Winds of force 4 and above		
	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)	Number of hauls	Catch/ hour (kg)	Mean log (catch/ hour)
1	11	39.6	1.5979	3	10.3	1.0111	36	6.0	0.7779	10	6.0	0.7804
2	56	9.5	0.9782	53	8.1	0.9091	23	5.0	0.6964	5	4.0	0.5975
3	35	18.9	1.2759	5	12.2	1.0869	12	4.8	0.6778	1	6.0	0.7782
4	42	7.3	0.8655	7	27.8	1.4447	11	6.2	0.7941	3	6.9	0.8368
5	23	31.2	1.4935	-	-	-	-	-	-	-	-	-
6	150	14.9	1.1722	56	11.9	1.0751	26	3.7	0.5692	17	5.1	0.7103
7	24	9.8	0.9929	23	10.3	1.0111	12	6.7	0.8238	26	4.8	0.6778
8	39	19.2	1.2828	2	12.7	1.1047	130	8.4	0.9255	44	6.0	0.7801
Total	380			149			250			106		
Mean		14.2	1.1511		10.5	1.0231		6.7	0.8236		5.5	0.7369
F			10.4986 (S)			2.0010			6.0935 (S)			0.8351

Table 10 - Wind directions in descending order of mean log (catch/hour fishing) at wind strengths below and above force 4

	Sole	Plaice
Area 1		
Winds below 4	5 3 1 8 6 4 2 7	1 5 8 3 6 7 2 4
Winds of force 4 and above	4 3 8 2 7 6 1	4 8 3 6 7 1 2
Area 2		
Winds below 4	8 1 6 2 7 3 4	8 7 4 1 2 3 6
Winds of force 4 and above	8 1 7 6 1 4 3	4 1 8 3 6 7 2