Northwest Atlantic Fisheries Organization

Serial No. N4309 **NAFO SCR Doc. 00/67**

SCIENTIFIC COUNCIL MEETING – SEPTEMBER 2000

Greenland Halibut Depth Variations of Catch-per-unit Effort, Length Composition, Mature Proportions and Associated By-catches in Divisions 3LMNO

by

Susana Junquera
Instituto Español de Oceanografía, Aptdo. 1552, 36280 Vigo, Spain
e-mail: susana.junquera@vi.ieo.es

Antonio Vázquez
Instituto de Investigaciones Marinas, Eduardo Cabello 6, 36208 Vigo, Spain
e-mail: avazquez@iim.csic.es

and

Enrique de Cárdenas
Instituto Español de Oceanografía, Av. De Brasil 31, 28020 Madrid, Spain
e-mail: e.decardenas@md.ieo.es

Abstract

In this paper we present a review of the geographic and bathimetric patterns of occurrence of the Greenland halibut catches in NAFO Divisions 3LMNO and their incidence on the catch of other stocks, namely cod, American plaice and yellowtail and witch flounders. The Greenland halibut mature proportions at depth in both the commercial catches and the spring Spanish 3NO survey indices are also presented.

According to the results of the Spanish fleet, the Greenland halibut fishery does not overlap significantly with either American plaice, yellowtail flounder, skate or cod. By-catches of witch flounder in the Greenland halibut fishery have been very small, at least in 1999. The CPUE analysis indicate that Greenland halibut is best caught in the deepest strata, with catch rates comparatively poor at depths less than 600 m. Besides a sharp change in catchability is observed between 500 – 600 m. The proportion of mature fish in the catches increases with depth attaining a maximum between 1200 – 1600 m. The survey results indicate that most part of the SSB is found at depths beyond 800 m.

Introduction

The Scientific Council pointed in several times the necessity of reducing exploitation of juvenile fish and to keep the by-catches, particularly of the stocks under moratoria, to the lowest possible levels (Anon. 2000). The Southeast of the Grand Banks (Div. 3NO) has been identified by the NAFO Scientific Council as a nursery area for cod, American plaice, yellowtail and witch flounders. In several occasions has been stated that significant catches of these stocks are taken in the fisheries targeting Greenland halibut.

In this paper we present a review of the geographic and bathimetric patterns of occurrence of the Greenland halibut catches in Div. 3LMNO and their incidence on the catch of other stocks, namely cod, American plaice, redfish, yellowtail and witch flounders. The Greenland halibut length compositions and mature proportions in both the commercial catches and the Spanish 3NO survey are also presented.

Materials and Methods

Two sources of data have been used:

(a) Data on the Spanish commercial catches and by- catches recorded by scientific observers of the national network (1990 – 1999). Catch records were available in a tow by tow basis. They were characterised by the vessel, date, depth and NAFO Division.

In order to assess the performance by depth of the fishery targeting Greenland halibut, catches of this species were adjusted to a multiplicative model (Vázquez and Larrañeta, 1980) with the following structure:

$$Y/f = F_v \times F_d \times F_{yd} \times F_{md} \times F_{dd}$$

Y/f	Monthly catch in Kg per hour towed	3289 cases
F_v	Vessel factor	50 cases
F_v	Division factor	3 cases: 3LMN
F_{yd}	Year factor for each Division	26 cases: 1990-1999 × Div.
F_{md}	Month factor for each Division	36 cases: 1-12 × Div.
F_{dd}	Depth factor for each Division	47 cases: 100-1700 m × Div.

According to this model, the year, month and depth factors are considered independent among Divisions, so they can account for different patterns for each Division. Only the vessel factor, the one responsible for catchability, is considered constant for all year - month - depth combinations. The number of factors involved is presented in the table 1. Catch records were grouped by months, so the 29515 tow records were summarised in 3289 cases. Catches in Division 3O were not considered because they showed poor consistency with the model in a previous analysis. Also, not all possible combinations of the factor were available, some of the possible factors are missing. The year factor for each Division, for example, has only 26 cases from a total possibility of 27 cases: 9 years times 3 Divisions. The depth factor was considered by 100 meters intervals. The model assumes a normal distribution of the monthly catch rates, with the variance being a power (k) of the expected CPUE, and each vessels having a characteristic ratio (V_v).

$$V(C/f) = (F_v \times F_d \times F_{yd} \times F_{md} \times F_{dd})^k \times V_v / f$$

Greenland halibut length distributions by 100 meters intervals weighted to the sampled catch are used to obtain the mature proportion of the sampled catches by applying the maturity curve from Junquera and Saborido-Rey (1995) and Junquera et al. (1999). The length at 50 % maturity in this case is between 65 and 70 cm.

It must be noted that the scientific observers coverage varied substantially through the period considered, from 100 % coverage in 1991and 1992, 33 % till 1996, falling since then to less than 5 % at present. So the term 'catches' refers to the sampled catches every year and not to the true total catches of the fleet. In table 1 is presented the fishing effort surveyed by the observers in the period 1991 – 1999. In spite of the low coverage in the last period of the time series, the trends of the fleet activity (i.e. patterns in depth distribution of the fishing effort) are properly reflected in our opinion, though total catch figures cannot be deduced from those data.

(b) Data on Greenland halibut biomass and abundance indices and length distributions by 100 meters intervals from the Spanish spring bottom trawl survey in Div. 3NO in the period 1995 – 1999. The description of this surveys performance are found in Paz et al. (1999). The length distributions by depths and the maturity curve are used to obtain the mature fraction of the total biomass index.

Results

- **Depth distribution of commercial catches.**

The depth distribution of Greenland halibut, redfish, skate and American plaice catches are presented in Fig. 1. Only data from 1999 are shown in this figure, as a case example of the current performance of the Greenland halibut fishery.

In Div. 3L no Greenland halibut are registered at depths less than 700 m. The magnitude of these catches increases sharply from 1000 to 1400 m and disappear beyond 1500 m. In this same range, 7 % (in weight relative to the total catch) of redfish have been caught. Less than 1 % of American plaice and witch flounder appeared at depths between 900 – 1000 m. depth. No cod catches has been registered.

In Div. 3M Greenland halibut have been caught at depths between 600 and 1600 m, with a peak in the 1200 – 1300 m. depth interval. No catches of this species are registered at depths less than 600 m. In this same depth range 13 % of redfish (in weight) and 4 % of skate have been caught. Occasional presence of witch flounder (0.07 %), and American plaice (0.04 %) were recorded only in the 900 –1000 m. interval, without presence of cod catches.

In Div. 3N the catch composition in terms of weight was as follows: 9 % of Greenland halibut, 4 % of redfish, 28 % of skate, 34 % of American plaice, 14 % of yellowtail flounder, 4 % of cod and less than1 % of witch flounder. Greenland halibut catches are taken at depths between 700 – 1400 m., and only 1 % of them occurs at shallower depths. Skate are caught exclusively at depth less than 200 m. and American plaice, yellowtail flounder and cod only above 400 m. depth.

In Div. 3O, 70 % of the catch in weight was redfish, 13 % Greenland halibut and 11 % American plaice. No presence of cod, witch or yellowtail flounders have been recorded. Greenland halibut catches occurred at depths between 700 – 1000 m, redfish up to 800 m and American plaice up to 500 m.

According to this pattern of depth distribution of catches it can be seen that, at least in the case of this fleet, the Greenland halibut fishery do not overlap significantly with either American plaice, yellowtail flounder, skate or cod.

- **Catch per unit effort analysis.**

Results of the CPUE analysis are presented in table 1. Values of the depth factor in Divisions 3LMN (table 1, Factor 5) are presented in figure 2.

The maximum value of the depth factor occurs at the 600-700 meters interval in all Divisions. The value of this factor decline for deeper strata on different degrees for each Division. The decline is small in Division 3L and it is maximum in Division 3M. The values of this factor at depths less than 600 meters reaches the smallest values observed and they approach to zero in shallowest strata. They are smaller than any of the values observed for the strata considered with more than 600 meters depth.

The above result supports the well known fact that Greenland halibut is best caught in the deepest strata. Besides the results show a sharp change in catchability occurring between the 500 and 600 meters depth strata, that is to say, catch rates of Greenland halibut at depths less than 600 meters are comparatively poor.

- **Greenland halibut length distributions and mature proportions at depth.**

The mean lengths at depth intervals in both the commercial catches and the Spanish spring survey in Div. 3NO are presented in table 3. The year 1991 is the one when this fishery was established. At that time Div. 3N was not exploited. The years 1997 to 1999 are included to allow comparisons with the results of the survey, as since 1997 the same depths as the commercial fleet are covered. As was already known, it can be seen that mean length of fish increases with depth in both the catches and the survey. The mean length in the first year of activity of this fleet (1991) was higher than the current ones, particularly in the deepest strata (1000 m. onwards).

The proportion of mature fish (female based) obtained from the catch length distributions at depth are presented in table 4. This proportion increases with depth, generally attaining a maximum at the 1200 – 1600 m. interval in all divisions. The proportion of adult fish in the catches was higher in the first year of activity of this fleet (1991) than it is at present and also this proportion is always smaller in Div. 3N than in Div. 3M and 3L.

In table 5 are presented the Greenland halibut biomass indices, an estimate of the SSB and how this is distributed by depth intervals in the Spanish spring bottom trawl survey in Div. 3N. Excluding the year 1995 which

do not covered all the depth range, the proportion of mature biomass over the total biomass indices seems rather stable, around an average value of 25 %. As it was observed in the fishery data, most part of the adult fish is found at depths beyond 800 m.

References

Anon. (2000) – Scientific Council Report . *NAFO SCS Doc*. 00/**24**.

Junquera, S. and F. Saborido-Rey (1995).- Histological assessment of sexual maturity in Greenland halibut in Div. 3LM and 3N . *NAFO SCR Doc*. 95/**28**.

Junquera, S.; E. Román; X. Paz and G. Ramilo (1999).- Changes in Greenland halibut growth, condition and fecundity in the Northwest atlantic (Flemish Pass, Flemish Cap and southern grand Bank*). J. Northw. Atl. Fish. Sci.* **25**: 17 – 28.

Paz, X. and P. Durán (1999).- Results from the 99 Spanish bottom trawl survey in the NAFO Regulatory Area for Divisions 3NO. *NAFO SCR Doc*. 99/**57**.

Vázquez, A. and M.G. Larrañeta (1980). Assessment of cod stock in Division 3NO. *NAFO SCR Doc*. 80/II/**10**.

Table 1– CPUE analysis results.

```
k        =    1.175
Fnm      =    1.000  1644  1645
Skew     =    0.533
Curtoses =    4.665


Total number of degrees of freedom:  3027

 n     name cases  value  sd(f)     Catch     Efort     Y/f
-----------------------------------------------------------

      total  3289                40201701    147654  272.27

FACTOR 1

                                                                V
                                                               ----
 1      V 1   172  1.000  0.036   1516288      6657  227.77     1.00
 2      V 2    39  2.541  0.082    708955      1049  675.91     0.32
 3      V 3    33  1.337  0.092    253831       778  326.33     0.59
 4      V 4    34  1.671  0.062    505988      1289  392.47     0.34
 5      V 5   150  2.170  0.055   4221886      6398  659.83     1.20
 6      V 6   115  1.678  0.040   2443966      5878  415.80     0.67
 7      V 7    25  1.601  0.118    509617       948  537.48     1.26
 8      V 8     3  3.207  0.490     58440        73  802.38     0.58
 9      V 9    21  1.275  0.228    277300      1431  193.76     4.30
10      V10   116  0.723  0.018    677538      4312  157.13     0.25
11      V11    62  1.227  0.027   1247115      4789  260.40     0.32
12      V12   125  1.456  0.032   1823836      5253  347.17     0.42
13      V13    96  1.076  0.018   1241495      5062  245.27     0.17
14      V14    33  1.047  0.026    430186      2277  188.90     0.14
15      V15    51  1.317  0.047   1090074      3402  320.43     0.69
16      V16    60  1.056  0.041    170951      1945   87.91     0.15
17      V17    44  0.924  0.032    269797      1966  137.25     0.18
18      V18    98  1.560  0.051   1561372      4787  326.20     0.83
19      V19    29  1.309  0.043    286769      1160  247.29     0.16
20      V20   107  0.900  0.018   1077365      5645  190.86     0.24
21      V21    40  0.698  0.029    190034      1613  117.78     0.20
22      V22    74  0.998  0.031   1038738      4599  225.87     0.52
23      V23    83  1.545  0.042   1630042      4254  383.20     0.57
24      V24    54  1.073  0.032    728882      2730  267.00     0.34
25      V25    78  1.157  0.027    933868      4056  230.22     0.27
26      V26    66  1.473  0.053    886734      2778  319.17     0.56
27      V27    20  0.919  0.059    239289      1299  184.17     0.54
28      V28    24  0.639  0.036    113227       956  118.41     0.21
29      V29    48  0.903  0.026    624948      2556  244.51     0.28
30      V30    66  0.835  0.018    747276      3046  245.32     0.17
31      V31   111  1.041  0.042   1247752      5151  242.25     1.07
32      V32   108  1.369  0.063   1676517      4251  394.42     1.69
33      V33    64  1.088  0.028   1044796      3402  307.13     0.35
34      V34    52  0.609  0.021    475089      2763  171.94     0.32
35      V35   102  0.777  0.018    668873      3135  213.38     0.19
36      V36    41  0.772  0.065    371416      1845  201.33     1.42
37      V37   107  1.053  0.031    673198      2591  259.82     0.30
38      V38    15  1.532  0.154    228610       577  395.98     1.12
39      V39    41  0.904  0.017    399433      1653  241.71     0.07
40      V40    73  0.787  0.023    645864      3527  183.13     0.30
41      V41    44  0.753  0.033    355403      1954  181.92     0.38
```

42	V42	43	0.647	0.041	235233	1487	158.23	0.53
43	V43	94	0.867	0.014	1082181	4845	223.37	0.16
44	V44	50	0.722	0.023	479710	2343	204.76	0.26
45	V45	101	0.767	0.020	741559	3815	194.39	0.27
46	V46	51	0.597	0.017	364223	3054	119.28	0.17
47	V47	31	0.775	0.025	201230	1722	116.85	0.12
48	V48	47	0.502	0.013	171231	1594	107.44	0.07
49	V49	114	1.390	0.046	1075353	3731	288.20	0.60
50	V50	34	2.573	0.103	558223	1231	453.35	0.42

FACTOR 2

1	L1992	641	1.000	0.009	11356949	31464	360.95
2	L1993	290	0.741	0.009	2558136	15055	169.92
3	L1991	268	0.872	0.013	3737834	13650	273.83
4	L1990	147	1.224	0.026	3512945	5634	623.49
5	L1997	72	0.827	0.035	966916	2493	387.93
6	L1996	71	0.871	0.029	1226794	3379	363.06
7	L1998	54	0.735	0.023	552735	2227	248.15
8	L1999	41	0.881	0.047	543985	1848	294.43
9	L1995	12	0.767	0.038	111254	475	234.47
10	M1992	427	1.000	0.011	5248609	19855	264.35
11	M1991	352	0.944	0.011	3476916	20743	167.62
12	M1993	144	0.798	0.020	641964	4078	157.41
13	M1990	102	1.362	0.042	1191443	3306	360.40
14	M1999	61	0.686	0.026	611067	2800	218.24
15	M1996	43	1.086	0.054	335118	1227	273.16
16	M1998	36	0.933	0.046	359453	1136	316.37
17	M1997	30	0.763	0.064	228761	1058	216.17
18	N1993	295	1.000	0.013	2673765	12455	214.68
19	N1992	68	1.051	0.049	460046	1595	288.42
20	N1998	34	0.608	0.024	124590	1187	105.00
21	N1991	26	1.168	0.105	28639	709	40.40
22	N1997	25	0.878	0.085	124966	455	274.59
23	N1999	25	0.590	0.056	71334	400	178.41
24	N1995	12	0.684	0.063	21228	203	104.31
25	N1996	11	0.578	0.109	35877	169	212.39
26	N1990	2	0.318	0.525	377	53	7.07

FACTOR 3

1	L5	197	1.000	0.014	4173363	11602	359.71
2	L4	171	0.979	0.017	3055674	8350	365.97
3	L9	159	0.648	0.012	1957358	7021	278.77
4	L2	149	0.913	0.019	2244297	5890	381.05
5	L3	139	0.872	0.019	1930311	6130	314.89
6	L10	136	0.607	0.014	1905189	6507	292.79
7	L8	127	0.699	0.013	1563575	6589	237.31
8	L11	125	0.655	0.016	1879543	5990	313.76
9	L6	124	0.769	0.014	2129038	7610	279.77
10	L12	110	0.944	0.024	1624910	4215	385.52
11	L7	81	0.792	0.018	1180703	3761	313.90
12	L1	78	1.067	0.028	923587	2560	360.76
13	M3	156	1.000	0.019	2026689	8334	243.19
14	M10	125	0.676	0.016	970535	5835	166.33
15	M2	121	1.188	0.024	1668370	6027	276.80
16	M11	115	0.697	0.017	964776	6200	155.61
17	M8	111	0.850	0.019	1016792	4857	209.36
18	M9	109	0.765	0.017	1154687	5725	201.69
19	M4	105	1.200	0.028	1345053	5011	268.41
20	M5	93	1.081	0.032	795643	3412	233.17

21	M7	70	0.971	0.029	593848	2705	219.53
22	M6	65	1.000	0.033	688165	2316	297.15
23	M1	65	1.276	0.043	595408	2086	285.45
24	M12	60	0.732	0.034	273365	1695	161.26
25	N10	91	1.000	0.034	412396	2682	153.79
26	N9	90	1.170	0.038	468862	2381	196.89
27	N8	52	1.102	0.039	538946	2248	239.73
28	N7	49	1.196	0.038	456890	2273	200.99
29	N11	46	1.157	0.039	401911	2181	184.25
30	N4	41	1.548	0.040	382690	1427	268.23
31	N6	37	1.367	0.049	295290	1677	176.06
32	N3	25	1.435	0.095	92578	399	232.26
33	N5	23	1.565	0.062	274991	1110	247.85
34	N12	19	1.379	0.088	147063	503	292.42
35	N2	13	1.253	0.178	47977	142	338.86
36	N1	12	1.242	0.114	21228	203	104.31

FACTOR 4

1	L	1596	341.251	1.966	24567548	76225	322.30
2	M	1195	231.243	1.655	12093331	54203	223.11
3	N	498	217.110	2.436	3540822	17226	205.55

FACTOR 5

1	L1000	303	1.000	0.012	6047254	19643	307.86
2	L 900	289	1.031	0.014	4620637	14235	324.61
3	L1100	274	0.962	0.014	3735003	11704	319.13
4	L 800	243	1.033	0.013	4379712	13440	325.86
5	L1200	174	1.013	0.018	2663529	7783	342.23
6	L 700	128	1.107	0.022	1849015	5378	343.81
7	L1300	71	0.934	0.033	797564	1852	430.76
8	L1400	29	0.864	0.063	229157	480	477.84
9	L 600	28	1.232	0.092	154834	444	348.40
10	L 100	11	0.111	0.018	13322	333	40.03
11	L 200	11	0.161	0.034	6982	439	15.92
12	L1500	10	1.056	0.160	46465	86	537.69
13	L 400	7	0.435	0.171	6062	110	55.07
14	L 500	7	0.722	0.179	5434	48	114.12
15	L 300	6	0.205	0.059	4092	229	17.89
16	L1600	5	0.871	0.254	8486	24	359.07
17	M1100	268	1.000	0.011	4802459	19989	240.26
18	M1000	264	1.045	0.016	2945282	11372	258.98
19	M 900	187	1.131	0.027	1112882	4204	264.73
20	M1200	169	0.934	0.017	1819629	8256	220.41
21	M1300	86	0.826	0.023	723235	3843	188.20
22	M 800	78	1.109	0.050	254210	1288	197.31
23	M1400	41	0.683	0.032	257968	1830	140.99
24	M 700	23	1.034	0.109	73855	391	188.95
25	M 200	22	0.021	0.005	6751	1388	4.87
26	M 300	17	0.043	0.022	1859	268	6.93
27	M1500	16	0.466	0.044	74129	893	83.01
28	M 100	14	0.002	0.002	260	359	0.72
29	M 600	6	1.221	0.220	18105	97	186.30
30	M 500	2	0.394	0.259	663	9	73.94
31	M1600	2	0.595	0.283	2044	17	123.88
32	N 900	83	1.000	0.022	896426	4262	210.33
33	N1000	75	0.976	0.025	665370	3122	213.09
34	N 800	72	1.053	0.029	667885	2827	236.21
35	N1100	68	0.922	0.028	511029	2501	204.36
36	N1200	44	0.980	0.037	364006	1666	218.43

37	N 700	41	1.174	0.044	245001	1048	233.79
38	N 100	24	0.100	0.011	21811	761	28.65
39	N 600	19	1.285	0.096	45717	179	255.76
40	N1300	17	1.017	0.093	94837	366	259.08
41	N 200	15	0.126	0.021	7214	231	31.26
42	N 300	10	0.148	0.052	2239	56	40.16
43	N 500	10	0.499	0.128	5768	77	74.75
44	N1400	9	0.732	0.185	9419	67	140.06
45	N 400	6	0.133	0.089	887	38	23.31
46	N1500	3	0.609	0.241	1999	16	123.02
47	N1700	2	0.829	0.634	1214	7	161.87

determination coefficient: 0.616

Table 2. Distribution of the fishing hours by depth intervals covered by the scientific observers sampling program from 1991 to 1999.

	DIV. 3L								
Depth (m.)	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
0- 99			6						
100-199	275	17	4	34			7		
200-299	40	48	13						
300-399	13	3							
400-599	15	16	14	6				6	
600-799	451	3011	1550	2132	140	91	330	340	37
800-999	3232	13824	11996	5549	206	1072	783	1061	191
1000-1199	6219	13066	10615	3577	100	1411	1012	785	1034
1200-1700	930	5800	3255	1782	29	831	368	51	584
TOTAL	11174	35784	27451	13081	475	3405	2500	2243	1845
	DIV. 3M								
Depth (m.)	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
0- 99									
100-199	69	346	101						
200-299	381	32	261	17			187		
300-399	35	5	63	155			131		
400-599	5	6							
600-799	31	369	50	9				177	184
800-999	1134	2490	2037	1195		183	213	133	108
1000-1199	11562	13347	4773	5180		839	471	756	535
1200-1700	7328	5023	731	1533		207	57	72	1985
TOTAL	20545	21618	8015	8090		1228	1058	1138	2812
	DIV. 3N								
Depth (m.)	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
0- 99	873	669	412	771			924	42	532
100-199	397	236	159	435	5		38	3	55
200-299	176	149	38	236				5	
300-399	37		10	31			5		5
400-599	10	7	27	166				52	34
600-799	7	296	1150	1566	14		24	145	30
800-999	39	2866	7139	4898	104	96	220	743	131
1000-1199	23	2187	6043	3639	76	65	144	217	75
1200-1700	4	148	2718	2605	4	13	24	29	70
TOTAL	1566	6557	17695	14347	204	174	1379	1237	932
	DIV. 3O								
Depth (m.)	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
0- 99	8	104	79	2			5	14	
100-199	7	490	307	92				68	16
200-299	4	43		38				33	
300-399	4	4						24	4
400-599								24	23
600-799	5							0	5
800-999				130					
1000-1199			9	439					12
1200-1700			15	222					3
TOTAL	29	641	411	922			5	165	64

Table 3. Mean lengths (cm) at depth in the Spanish Greenland halibut fishery and in the Spanish bottom trawl survey in Division 3N. N.s.= not surveyed strata.

	SURVEY						***CATCHES***			
	Div. 3N						***Div. 3N***			
Depth (m.)	1995	1996	1997	1998	1999	Depth (m.)	1991	1997	1998	1999
0 - 99	17	25	28	35	30	600 - 799		38	39	40
100 - 199	21	27	26	35	28	800 - 999		42	41	49
200 - 299	27	25	22	28	28	1000 - 1199		44	42	50
300 - 399	31	26	26	29	31	1200 - 1600+			41	48
400 - 599	26	27	29	29	33		***Div. 3L***			
600 - 799	35	34	30	32	35	600 - 799	45	42	40	48
800 - 999	n.s.	41	40	38	36	800 - 999	51	44	41	46
1000 - 1199	n.s.	47	46	46	42	1000 - 1199	54	45	44	47
1200 - 1600+	n.s.	n.s.	n.s.	46	45	1200 - 1600+	60		55	48
							Div. 3M			
						600 - 799			46	46
						800 - 999		47	51	50
						1000 - 1199	58	47	44	49
						1200 - 1600+	63		53	52

Table 4. Percentages of mature fish (actual numbers of mature fish sampled in brackets) by depth in the Spanish Greenland halibut commercial catches.

	Div. 3L			
Depth (m.)	1991	1997	1998	1999
600 - 799	14 (19038)	8 (15840)	10 (11114)	23 (1711)
800 - 999	28 (195368)	14 (54419)	10 (32694)	19 (9769)
1000 - 1199	37 (419875)	15 (70637)	10 (11119)	19 (65674)
1200 - 1600+	50 (58894)	-	40 (1616)	21 (36779)
Total of the year	33 (693175)	13 (140896)	12 (56538)	20 (113933)
	Div. 3M			
Depth (m.)	1991	1997	1998	1999
600 - 799	-	-	17 (3732)	17 (9056)
800 - 999	-	21 (11436)	31 (7579)	29 (11204)
1000 - 1199	46 (524050)	19 (34090)	17 (3733)	26 (39000)
1200 - 1600+	56 (266474)	19 (34090)	34 (2013)	33 (87729)
Total of the year	49 (790524)	20 (79616)	17 (17055)	29 (146989)
	Div. 3N			
Depth (m.)	1991	1997	1998	1999
400 - 599	-	-	0 (0)	-
600 - 799	-	5 (445)	8 (2649)	5 (627)
800 - 999	-	14 (54394)	8 (11046)	25 (6482)
1000 - 1199	-	12 (7164)	9 (2517)	24 (4336)
1200 - 1600+	-	13 (8167)	12 (771)	5 (670)
Total of the year	-	14 (70169)	9 (16982)	21 (12115)

Table 5. Greenland halibut total biomass index, spawning stock biomass index , percentage of the SSB index over the total biomass index and percentages of the SSB index by depth strata (m) in the spring Spanish bottom trawl surveys (n.s. = not surveyed).

				Percentages of SSB by depth strata (m.)								
Year	**Biomass**	**SSB**	**%**	**0-99**	**100-199**	**200-299**	**300-399**	**400-599**	**600-799**	**800-999**	**1000-1199**	**1200-1600**
1996	34246	8124	24	0	0	0	0	0	4	74	22	n.s
1997	71000	21731	31	0	0	0	0	0	0	9	90	n.s
1998	147864	33657	23	2	2	0	0	0	3	35	28	29
1999	121043	31664	26	0	0	0	0	0	5	16	42	36

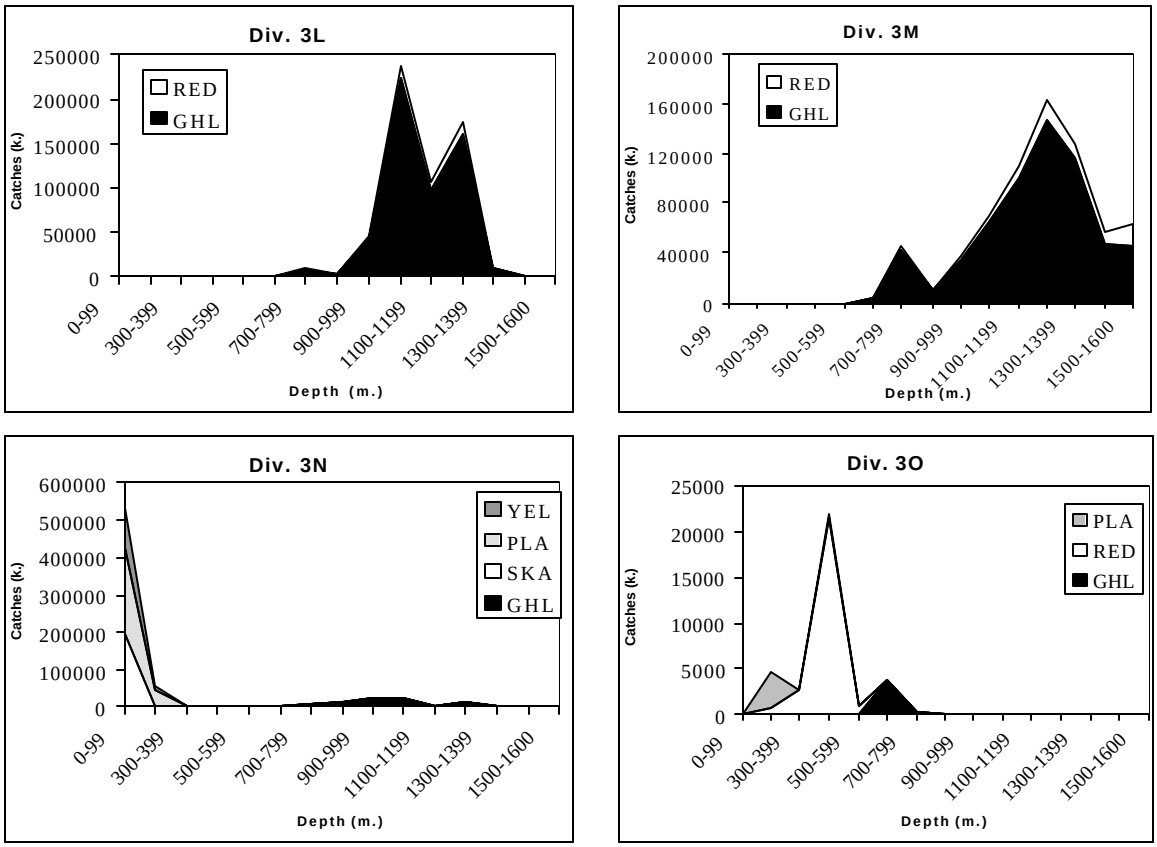

Fig 1. Depth distribution of the catches as recorded by the scientific observers on board the Spanish trawler fleet in 1999. GHL = Greenland halibut; RED = redfish; SKA = skate; PLA = American plaice; YEL = yellowtail flounder.

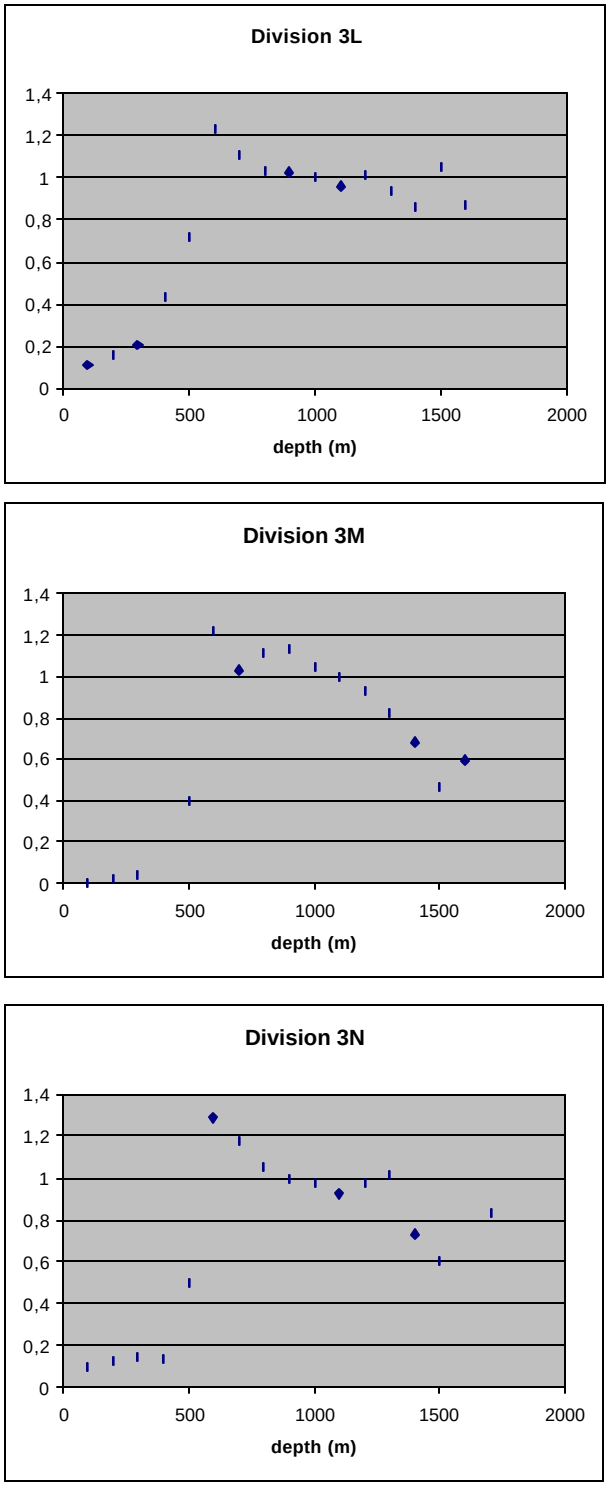

Fig. 2. – Depth factor by Division vs depth in meters.