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# **SCIENTIFIC COUNCIL MEETING – JUNE 2012**

Update on the distribution and abundance of witch flounder (*Glyptocephalus cynoglossus*) on the Flemish Cap and in the Flemish Pass based on Canadian and EU research vessel surveys 2003-2011.

by

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#### Introduction

Small catches of witch flounder (Glyptocephalus cynoglossus) have been consistently reported in Division 3M since 1986. In 2001, a special comment in the Scientific Council report on the status of witch flounder in the North Atlantic Fisheries Organization (NAFO) Divisions 2J3KL stated that "the relationship between witch flounder in Division 3M and the Divisions 2J, 3K and 3L stock warrants investigation". In 2002, Fisheries Commission, with the concurrence of the Coastal State, requested that: "the Scientific Council comment on the possible relationship of witch flounder in Div. 2J+3KL to that reported as caught in Div. 3M based on examination of all survey and biological data available." To address this request, Bowering and Vazquez (SCR 02/75) examined research vessel survey data (1978-2001) from the area of the Flemish Pass and Flemish Cap in order to investigate the possibility that the witch flounder reported as caught in Division 3M, where catch of witch is unregulated, might be related to witch on the Grand Bank. Based on that work, it was concluded that the witch flounder in Div. 3M is not likely strongly linked to the 2J3KL witch stock, and that catches in the area would likely be very low. In 2011, the standing committee on fisheries science (STACFIS) of NAFO noted that "witch flounder catch reported as taken in NAFO Div. 3M has the potential to belong to the 2J3KL witch flounder stock, therefore STACFIS recommended that the origin of the catch of witch flounder reported as caught in NAFO Div. 3M be explored." To address this most recent concern, abundance and biomass of witch and the distributions from the Canadian autumn surveys and the EU summer surveys were examined for 2003-2011.

#### **Materials and Methods**

Biomass estimates and distribution of witch flounder were available from Canadian autumn surveys that covered NAFO Divs. 2J3KL from 2003-2011 to depths of 1500m. Some sets were also conducted in Div. 3M during the Canadian autumn surveys in 2003, 2006 and 2007. The EU summer survey covered the Flemish Cap and Flemish Pass annually from 2003-2011, and also provided biomass estimates and distribution of witch. The 2003 EU survey covered depths up to 740m on the Cornide de Saavedra and since then, the survey has covered up to 1450m with the Vizconde de Eza. The number of fish per survey set were plotted for Canadian and EU surveys, and although direct comparisons between EU and Canadian surveys are not possible, the distribution of catches and sets where no witch were captured can be examined for continuity of witch distribution in this area. Catch of witch flounder reported by Division were also available from the STATLANT 21A database.

#### Catch

#### Results

Table 1 and Figure 1 give the catch of witch flounder for Divs. 2J3KL and Div. 3M from 1960-2011 as well as the TACs for Divs. 2J3KL. Witch flounder catches in 2J3KL have been very small (less than 300 t annually since 2004) compared to the commercial catch levels in the early 1970s when landings ranged from 16 000 to 24 000 t. Catches of witch have been strictly by-catch since a moratorium on fishing was established for Canadian fleets in 1995 and extended into the NAFO Regulatory Area in 1998. Most of the witch was taken as by-catch in the Greenland halibut and redfish fisheries. In Div. 3M, witch flounder is not a regulated species, and was also taken as by-catch in the Greenland halibut and redfish commercial fisheries. In 2010, the moratorium on cod fishing in Div. 3M was lifted and some witch was also taken in this fishery. The level of witch by-catch in these fisheries is very low, however, and in the last decade has not exceeded 550 t.

Figure 2 shows the relationship between the EU-summer surveys in Division 3M with the catch reported from that Division. From 1988 to 2003, the EU-summer survey was conducted using the vessel Cornide de Saavedra and surveyed depths up to 740m. The survey biomass estimates from this survey series showed a negative relationship to the reported catch during those whole time series. Since 2003, this survey used a different vessel (Vizconde de Eza) and the depth surveyed increased to 1450m. Survey estimates in this time period are correlated, although the relationship is not strong (r2=.2) but improves if the estimate for 2008 is omitted (r2=.45).

#### Distribution

Distribution plots of witch flounder from the Canadian autumn and EU summer surveys of the Flemish Cap and Flemish Pass are given in Figures 3-11. Distributions are very similar to those reported in Bowering and Vazquez (2002) and show that in most years surveyed the survey sets in the area of the Flemish Pass and on the slopes bordering the Pass contain no witch flounder. When a survey did encounter witch flounder in this area, the catches were low.

#### Estimates of Biomass

Part of the Grand Bank extends into Division 3M (the Sackville Spur) and the reverse case also exists, where some strata on the Flemish Cap extend into Div. 3L. If a relationship exists between witch in Div. 3L and those in Div. 3M, it would be expected that the distribution of witch in the bordering strata would be continuous.

Biomass estimates of witch flounder from Canadian autumn surveys and EU-summer surveys since 2003 and 2004, respectively, are given by stratum in Tables 2 and 3. The strata in the area of the Flemish Pass where a continuous distribution of witch might suggest a relationship between Div. 3M and the Div. 2J3KL witch stock are highlighted. Abundance of witch flounder in these strata is negligible in most years surveyed and, in 2003, when the percentage of witch in the bordering strata reached 8% in the Canadian autumn survey, the set was not near the 3L 3M border (Fig.3). The EU-summer survey of Division 3M shows that most witch were found in shallower strata; with the exception of 2011, less than 1% of the survey catch of witch flounder was found in strata deeper than 731 m. In most years, less than 2% of the survey biomass of witch flounder was found in strata bordering NAFO Divisions 2J3KL. In 2011, 3% of the total biomass was found in bordering strata (Table 2).

#### Conclusions

Based on the lack of continuous distribution of witch flounder between NAFO Div. 2J3KL and Div. 3M and very low abundance and biomass in the area of the Flemish Pass, the previous conclusion that witch flounder in Div. 3M is not likely related to the Div 2J3KL witch stock is not refuted.

### References

BOWERING, W.R. and A. VAZQUEZ. 2002. Distribution and abundance of witch flounder on Flemish Cap and in Flemish Pass based on Canadian and EU research vessel survey data. NAFO SCR Doc. 02/75, Ser. No. N4689, 15p.

MADDOCK PARSONS, D. 2010. Witch Flounder in NAFO Divisions 2J, 3K and 3L. NAFO SCR Doc. 10/27, Ser. No. N5785, 40p.

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Year	2J	ЗK	3L	2J3KL	3M
1960	146	14	194	354	0
1961	35	51	46	132	1
1962	25	13	40	78	1
1963	38	263	644	945	0
1964	92	560	392	1044	2
1965	2547	1049	464	4060	0
1966	1268	2000	429	3697	3
1967	1357	1322	1422	4101	1
1968	1716	8119	831	10666	216
1969	4852	6457	1276	12585	0
1970	5604	9961	2465	18030	0
1971	1978	8462	5613	16053	0
1972	1443	11911	4074	17428	68
1973	1048	17624	4949	23621	248
1974	3497	10550	1916	15963	50
1975	1185	9621	1399	12205	9
1976	683	7533	2409	10625	1
1970	2267	5001	080	8318	17
1977	640	5761	503	6904	1
1970	188	3027	882	030 <del>4</del> ∕∩97	10
1080	100	2/06	286	2823	10
1980	41	2490	200	2023	10
1092	140	2102	624	2091	3
1902	149	2190	476	2901	4
1903	200	2412	470	3000	0
1904	100	4000	000	4013	3
1965	160	1990	040 2404	3003	0
1980	95	037	3104	3910	347
1987	1100	1141	2234	4475	317
1966	0 5	2007	957	4154	411
1989	5	3907	914	4906	501
1990	62	2494	1411	3967	534
1991	216	2241	1558	4015	398
1992	1	1259	1442	2702	218
1993	0	208	194	402	55
1994	0	8	129	137	484
1995	9	1	769	779	433
1996	2	2	1367	1371	250
1997	2	6	846	854	358
1998	2	0	432	434	755
1999	0	1	358	359	597
2000	8	19	449	476	746
2001	1	51	575	633	860
2002	1	82	442	525	384
2003	2	51	437	490	470
2004	0	11	279	290	547
2005	10	27	166	203	230
2006	0	53	24	77	22
2007	19	3	46	68	43
2008	0	7	77	84	155
2009	2	34	64	100	178
2010	47	78	112	237	343
2011	37	47	135	219	172

Table 1. Catch of witch flounder by Division 1960-2011 from STATLANT 21Adata.

Table 2. Biomass (kt) of witch flounder by stratum for NAFO Divisions 3L from the 2003-2011 Canadian Autumn Fall surveys. Highlighted strata border Division 3M.

Sum of	Biomass		YR								
DIV	Range	Str	03	04	05	06	07	08	09	10	11
3L	30-56	784	0	0	0		~ -	01.0			
	57-92	350	0.0	0.0	17.9	0.0	0.5	34.2	0.0	0.0	0.0
		303	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.9
		372	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		384	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		785	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
	93-183	328	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	12.6
		341	0.0	0.0	24.7	392.8	0.0	37.1	0.4	89.2	66.3
		342	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		343	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		348	17.4	0.5	0.4	0.4	0.0	0.0 91.0	0.0	22.0	26.6
		364	0.0	0.4	0.0	0.0	0.4	01.9	1.3	32.0 13.8	30.0
		365	0.0	0.0	21.5	0.0	0.0	0.0	0.0	0.0	0.0
		370	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.6
		385	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0
		390	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		786	0.6	0.3	1.2						
		/8/ 700	0.0	0.0	0.0	0.0				0.2	
		799	0.0	0.0	0.0	0.0				0.2	
		790	0.0	0.0	0.0	0.0				0.0	
		793	0.0	0.1	2.8					0.1	
		794	0.0	0.0	0.0	0.0				0.0	
		797	0.0	0.0	0.0	0.0				0.0	
	184-274	344	3.0	2.5	0.0	0.4	30.5	57.1	2.7	0.0	1.1
		347	0.0	0.0	0.0	0.0	0.0	1.4	0.0	17.2	51.4
		360	0.1		0.3	0.0	5.6 0.0	26.4	0.0	19.0	1.3
1		386	0.0		0.5	0.0	0.0	0.0	0.0	0.0	41.9
		389	0.0	0.4	0.0	4.9	0.0	0.0	0.0	0.0	0.0
		391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	404.000	795	0.0	0.0	0.0	0.1				0.0	
	184-366	789	0.0	0.1	0.1	0.2				0.0	
1		791	3.1	0.0	4.7 1 R					0.0	
1	275-366	345	5.2	0.5	35.6	42.5	13.8	254.8	33.1	160.0	78.4
		346	0.6	0.4	72.2	96.7	74.6	609.1	39.5	11.9	444.2
1		368	0.5		3.4	12.5	0.0	27.6	0.0	0.0	2.1
1		387	0.0		0.6	17.1	34.6	132.4	0.0	101.2	76.1
1		388	3.6	0.0	3.0	32.3	11.5	16.6	21.0	5.7	4.4
1		392	0.0	0.0 2 0	0.3	0.0	0.0	0.0	0.0	0.8 5 9	0.0
1		796	0.0	3.0 0.0	7.3 <u>9</u> 1	23			9.0	5.0 1 1	
	367-549	729	11.5	0.0	2.8	32.4	27.5	74.5	11.5	194.8	80.5
1		731	13.4	22.1	25.0	46.8	10.4	40.9	84.2	92.3	
1		733	8.1	248.0	230.3	166.1	370.4	26.3	207.4	226.0	435.5
		735	0.0		61.2	44.9	187.6	333.8	508.9	297.9	538.8
	EE0 704	792	45.3	49.2	79.0	47.0	14.0	4.0	20.0	24.8	46.5
	oou-731	730	0.2	105 7	0.0	47.9	14.0	4.2	38.9 252.0	08.0 336.2	46.5 139 /
1		734	4.4	100.7	0.0	83.6	43.7	19.0	468.0	219.0	653.1
1		736	104.4		195.4	758.3	777.0	832.4	932.1	955.7	547.6
1	732-914	737	67.9		48.4	10.9	0.0		0.0	80.3	
1		741	15.1			10.1	0.0		14.7	0.0	
1		745	7.2			0.0	0.0		0.0	22.5	
1	015 4007	748	37.2			0.0	0.0		0.0	5.0	
	915-1097	738	422.6			0.0	0.0		0.0	0.0	
1		742	7.4			0.0	0.0		0.0	0.0	
1		740	0.0			0.0	0.0		0.0	0.0	
1	1098-1280	739	0.0		0.0	0.0	0.0		0.0	0.0	
1		743	0.0			0.0	0.0		0.0	0.0	
1		747	0.0			0.0	0.0		0.0	0.0	
1	105	750	0.0		_	_	0.0		0.0	0.0	
1	1281-1463	740	0.0		0.0	0.0	0.0		0.0	0.0	
		744	0.0			0.0	0.0		0.0	0.0	
ta horde	ring Div 3M		146.8			10.1	0.0		14 7	22.5	
L biomass in bordering Strata		ata	8.0%			0.2%	0.0%		0.2%	0.2%	

	R/V VIZCONDE DE EZA (up to 1450 meters)							
stratum	2004	2005	2006	2007	2008	2009	2010	2011
1	849	1267	488	132	79	158	660	611
2	300	300	223	199	1480	240	749	188
3	64	36	28	80	193	41	23	66
4	71	46	32	56	21	24	17	107
5	154	30	22	55	129	72	103	19
6	30	16	22	26	49	38	63	127
7	16	20	10	3	34	38	10	52
8	15	1	0	7	24	25	10	15
9	2	2	1	6	0	9	0	56
10	23	31	34	15	100	67	89	83
11	16	11	7	13	81	38	9	93
12	0	0	0	0	2	0	4	4
13	0	0	0	1	0	0	0	0
14	6	13	22	2	11	1	13	25
15	2	0	0	2	11	7	60	3
16	6	3	0	0	0	1	5	3
17	0	0	0	0	0	0	0	0
18	0	0	5	0	0	0	0	22
19	0	0	0	0	0	4	20	7
20	0	0	0	0	0	0	0	1
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	15
20	0	0	0	0	2	0	0	10
20	0	0	0	0	2	0	0	1 0
28	0	0	0	0	0	0	6	0
29	0	0	0	0	0	0	1	9
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	8
32	0	0	0	0	0	4	0	0
total	1555	1776	894	596	2218	766	1842	1515
% Biomass in bordering strata	0.00	0.00	0.00	0.00	0.00	0.52	0.38	1.12
% of survey catch <731 m	100.0	100.0	100.0	100.0	99.9	99.5	99.8	98.1
% of survey catch >731 m	0.0	0.0	0.0	0.0	0.1	0.5	0.2	1.9

Table 3. Biomass (t) per strata of witch flounder in NAFO Div 3M from the 2004-2011 EU Survey (R/V Vizconde de Eza). Highlighted strata border NAFO Div 3L.



Figure 1. Catch of witch flounder in NAFO Divs. 2J3KL and Div. 3M from 1960-2011 (top panel) and expanded 1995-2011 (bottom panel)



Figure 2. Survey biomass estimates (000 t) from EU-summer surveys in NAFO Div. 3M compared to catch (000 t). From 1988-2003 the Cornide de Saavedra conducted the survey while the Vizconde de Eza surveyed during 2004-2011.



Figure 3. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Cornide de Saavedra; <740m) surveys in 2003.



Figure 4. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2004.



Figure 5. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2005.



Figure 6. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2006.



Figure 7. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2007.



Figure 8. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2008.



Figure 9. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2009.



Figure 10. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2010.



Figure 11. Distribution of witch flounder (*Glyptocephalus cynoglossus*) in NAFO Divs. 2J3KL and Div. 3M in Canadian autumn RV and EU-summer RV (Vizconda de Eza; <1450m) surveys in 2011.