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Assessment of Witch Flounder in NAFO Divisions 3NO

by

W. R. Bowering

Northwest Atlantic Fisheries Centre, Dept. of Fisheries & Oceans
P.O.Box 5667, St. John's, Newfoundland A1C 5X1

Catch history

Reported catches during the period 1971-84 ranged from a low of about 2,400 tons in 1980 and 1981 to as high as 15,000 tons in 1971 (Table 1; Fig. 1), however, from 1975-84 annual catches rarely exceeded 6,000 tons. With a substantial increase in effort in 1985 and 1986, especially by EU-Spain and EU-Portugal, catches rose rapidly to levels of 8,800 and 9,100 tons respectively. This increased effort was primarily concentrated on the "tail" of the Grand Bank in the NAFO Regulatory area of Division 3N. Non-Contracting parties such as South Korea, USA, Cayman Islands and Panama also contributed to increased catch levels. Catches remained relatively high in 1987 and 1988 at 7,600 and 7,300 tons respectively. During 1990-93 estimated catches were in the range of 4,000-5,000 tons. The estimated catch for 1994 was about 1,100 tons despite there being a moratorium on fishing this stock.

The main prosecutors of this fishery historically were Canada and the former Soviet Union. Canadian catches fluctuated from between 1,200 and 3,000 tons from 1985-91 but increased to about 4,300 tons in 1992 and 4,200 in 1993 (Table 1). Only 2 tons (by-catch) were reported by Canada for 1994 due to the moratorium. The increase in 1992 and 1993 was essentially the result of a quota transfer between Canada and the Russian Federation. Catches by the USSR/Russian vessels declined from between 1,000 and 2,000 tons in the period 1982-88 to less than 100 tons in 1989-90 and no catch since then.

The first total allowable catch (TAC) for this resource was introduced by ICNAF in 1974 at a level of 10,000 tons largely based on average historical catches (Fig. 1). This level remained in effect until 1979 when it was reduced to 7,000 tons in consideration of declining commercial catch rates. It was further reduced to 5,000 tons in 1981 and remained at that level to 1993. The Scientific Council advised that for 1994 catches from this stock should not exceed 3,000 tons. A TAC of 3,000 tons was agreed by the NAFO Fisheries Commission, however, it was also agreed that no directed fishery would be conducted for witch flounder in 1994 due to the poor state of the stock and to allow for rebuilding. A complete moratorium was introduced by the Fisheries Commission for directed fishing in 1995.

Commercial Fishery Data

Due to the closure of the fishery in 1994 no commercial fishery data are available. However, commercial fishery data from the Canadian fishery prior to the moratorium are available in NAFO SCR Doc. 94/49, Serial No. N2420.

Research Vessel Surveys

Stratified-random research vessel surveys have been carried out by Canada on the Grand Bank (including Div. 3NO) during spring since 1971 although during the early period coverage was limited and, in fact, for most years did not cover what may be considered an adequate depth range (survey maximum equal to 200 fathoms or 366 meters) to fully represent the distribution of witch flounder. Since 1990, on the other hand, depth coverage was extended to 400 fathoms or 720 meters which should be more representative but still not cover the entire range of depth distribution as observed in other areas in recent years. In addition to spring surveys, a time series of fall surveys was instituted in 1990 for seasonal comparisons. Total biomass estimates with confidence limits as well as biomass estimates by stratum for the spring surveys are presented in Tables 2 and 3 for Div. 3N and Div. 3O, respectively. A plot of the divisional biomass estimates is presented in Figure 2 for illustration.

Biomass Estimates

Estimated biomass in Div. 3N has been at very low levels throughout the time period and in most years was less than 1,000 tons (Table 2; Fig. 2). For Div. 3O estimates of biomass showed considerable annual fluctuations on average between 6,000 and 12,000 tons particularly in the late 1980's considered to be related to distributional differences (Table 3; Fig. 2). Nevertheless, the estimates illustrate a sharp decline in the last few years with the estimate for 1993 near the lowest observed. The most significant observation is that despite the fact that survey coverage during 1991-93 has been the most complete in the time series it indicates the a sharp systematic declining trend to levels as low as anything previously experienced. The biomass from the 1994 spring survey, on the other hand, estimated the biomass in Div. 3NO to be 6,800 tons largely as a result of good catches along the southwest slope of the Grand Bank in Div. 3O. The 1995 estimate was about 2,000 tons similar to the very low 1993 value.

A comparison of biomass and abundance of spring versus fall surveys is shown in Table 4; Fig. 3. In 1990 the fall estimate was higher than in spring whereas for 1991 and 1992 the reverse was true. The 1993 shift is similar to that of 1990. The differences, however, especially for the 1991-93 surveys were not large and still put the biomass and abundance estimates in both instances among the lowest levels observed. While the 1994 spring estimate was in the higher range, the fall estimate was more similar to that of the fall of 1993. The 1995 spring estimate is again near the lowest observed.

Based on the recent observations it would appear that there has been no improvement in the stock size. Without aging data it is not possible to comment on any recruitment prospects for the resource.

Table 1. Catches and TACs (t) of Witch Flounder in Div. 3NO from 1971-95.

Year	Country			Total	TAC
	Canada	USSR	Other		
1971	178	14774	13	14965	
1972	3419	5738	20	9177	
1973	4943	1714	34	6691	
1974	2807	5235	3	8045	10000
1975	1137	5019	12	6168	10000
1976	3044	2991	-	6035	10000
1977	3013	2742	4	5759	10000
1978	1165	2275	33	3473	10000
1979	1193	1868	16	3077	7000
1980	425	1994	1	2420	7000
1981	381	2044	-	2425	5000
1982	1760	1969	3	3732	5000
1983	1674	1942	-	3616	5000
1984	834	1955	13	2802	5000
1985	2746	1908	4117	8771	5000
1986	2937	1724	4470	9131	5000
1987	2829	1425	3342	7596	5000
1988	1927	1037	4361	7325	5000
1989	1241	81	2366	3688	5000
1990	2654	9	1516	4179	5000
1991	2624	-	2223 b	4847	5000
1992 a	4316	-	600 b	4916	5000
1993 a	4164	-	250 b	4414	5000
*1994 a	2	-	1117 b	1119	3000
1995	-	-	-	-	0

*Note: Although a TAC of 3000 tons was agreed by the FC, it was also agreed that no directed fishing be conducted in 1994 due to the poor state of the stock.

a = Provisional Data

b = Estimated

Table 2. Estimated biomass (tons) per stratum of witch flounder from research vessel surveys in Div. 3N from 1971-94.

Stratum	Depth (fath)	Area (sq. n. m.)	Units (000s)	Year 1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1982	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
375	<=30	1593	120	36	0	0	0	0	-	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
376		1499	113	-	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
Total				36	0	0	0	0	0	0	11	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
360	31-50	2992	225	-	25	-	-	0	305	38	586	725	265	1316	1139	61	404	366	898	101	0	0	18	92	0	0
361		1853	139	0	0	0	0	203	0	63	0	19	70	24	83	0	0	21	36	0	13	0	0	0	0	21
362		2520	189	344	0	0	0	0	0	0	0	15	26	0	0	44	38	0	96	0	0	0	0	0	0	0
373		2520	189	0	0	0	0	-	0	0	59	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
374		931	70	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	24	0
383		674	51	34	0	0	-	-	0	0	0	0	0	0	0	34	0	21	0	0	0	0	0	0	0	0
Total				379	25	0	0	203	305	101	645	775	361	1340	1222	138	442	408	1031	101	13	0	18	103	24	21
359	51-100	421	32	-	268	660	-	-	1368	58	-	86	44	190	134	35	60	28	126	133	0	0	0	10	0	0
377		100	8	-	0	0	8	0	-	99	0	10	19	0	6	0	0	38	2	17	0	0	0	0	0	0
382		647	49	-	0	0	0	-	0	30	0	0	39	0	0	0	0	6	0	0	0	0	0	0	0	0
Total				0	268	660	8	0	1368	186	0	96	102	190	140	35	60	72	128	150	0	0	0	10	0	0
358	101-150	225	17	-	50	41	-	-	-	102	-	19	5	42	21	186	20	76	13	14	27	0	23	65	51	2
378		139	10	12	5	14	30	-	-	50	123	79	26	21	13	12	18	91	14	17	0	4	12	0	0	0
381		182	14	6	12	0	0	15	-	74	155	35	17	14	17	4	20	55	38	0	38	0	0	0	0	0
Total				18	67	55	30	15	0	226	278	133	48	77	51	202	58	222	64	31	65	4	34	65	51	2
357	151-200	164	12	-	-	15	-	-	-	89	-	80	25	105	4	52	66	86	3	20	9	0	14	31	47	10
379		106	8	-	-	5	14	-	-	114	38	45	22	12	19	7	14	88	21	11	27	2	9	0	1	0
380		116	9	-	48	18	17	-	-	59	-	37	12	-	2	28	0	83	17	4	5	0	0	0	0	0
Total				0	48	39	32	0	0	262	38	161	59	117	25	88	81	256	42	35	41	2	23	31	48	10
723	201-300	155	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32	43	30	21	26
725		105	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	9	18	23	0
727		160	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	3	23	10	0
Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	56	71	54	26
724	301-400	124	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112	71	93	19	12
726		72	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38	13	16	13	2
728		156	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	11	59	13	115
Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	198	95	168	45	128
Biomass (tons)				432	408	754	70	218	1673	776	972	1165	570	1723	1438	462	641	965	1265	316	118	263	226	447	222	187
Lower limit				-3282	-449	-984	29	-123	-1305	421	-264	409	286	-974	453	-120	96	463	-567	-1040	-8	-734	84	229	UNK	-580
Upper limit				4847	1316	2491	126	560	4652	1115	2211	1921	852	3306	2424	1044	1182	1313	3097	1671	174	1259	348	669	UNK	954

Table 3. Estimated biomass (tons) per stratum of witch flounder from research vessel surveys in Division 3O from 1973-94.

Stratum	Depth (fath)	Area (sq. n. M.)	Units (ooos)	Year																			
				1973	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
330	31-50	2089	157	24	24	0	0	66	254	0	177	0	0	0	0	0	13	0	0	0	0	0	0	0
331		456	34	0	0	0	-	210	26	214	-	2	987	188	17	1	222	0	-	0	0	0	0	0
338		1898	142	1889	841	1530	517	20	46	627	-	40	100	4590	755	742	1728	1211	237	0	66	152	0	151
340		1716	129	-	0	282	0	73	406	0	52	9	17	82	0	14	0	0	5	0	75	0	0	0
351		2520	189	26	127	0	61	0	172	123	3689	74	422	165	303	163	613	140	62	0	0	0	0	0
352		2580	194	17	548	33	45	66	168	608	-	118	56	643	136	841	813	391	1021	23	58	35	0	40
353		1282	96	1806	714	1136	845	1093	153	722	-	2293	2406	802	741	1162	4205	1667	1035	0	144	122	0	24
Total				3763	2253	2981	1467	1528	1225	2294	3917	2536	3987	6470	1951	2923	7595	3409	2360	23	343	310	0	215
329	51-100	1721	129	0	-	3870	176	124	5	0	0	0	0	0	0	0	425	31	16	289	0	0	2501	61
332		1047	79	-	267	975	762	846	31	1218	-	5718	1493	4833	1218	1804	3181	813	2320	1390	1088	201	24	885
337		948	71	199	48	465	258	89	0	154	-	119	32	2113	825	894	539	877	971	892	349	278	27	329
339		585	44	130	0	-	-	130	106	-	296	20	176	0	4	149	80	0	0	0	0	0	0	0
354		474	36	797	-	501	81	-	42	302	9	267	285	71	605	151	231	17	141	74	73	463	0	0
Total				1126	316	5812	1276	1188	185	1675	305	6123	1986	7018	2653	2999	4457	1739	3447	2645	1511	941	2552	1275
333	101-150	151	11	-	8	18	3	17	4	37	-	220	5	27	3	0	33	5	67	222	33	28	2306	69
336		121	9	6	11	144	62	14	3	114	-	136	5	5	18	12	23	0	22	226	680	40	455	30
355		103	8	2	21	39	-	-	3	21	15	99	31	101	20	37	1	47	47	54	10	14	55	20
Total				7	40	201	64	32	10	172	15	455	40	132	42	49	57	52	136	502	722	82	2816	119
334	151-200	92	7	-	-	9	1	9	3	12	-	63	0	22	17	0	6	11	13	12	53	8	344	6
335		58	4	0	-	20	-	3	0	31	-	10	0	53	8	0	27	11	44	21	566	24	51	20
356		61	5	4	-	-	-	-	3	126	4	-	2	40	10	10	3	13	33	18	57	23	33	31
Total				4	0	30	1	13	6	169	4	72	2	115	35	11	36	35	90	51	677	55	428	57
717	201-300	93	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	26	11	603	9
719		76	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87	504	16	7	9
721		76	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	18	12	31	9
Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121	547	38	641	28
718	301-400	111	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	8	26	52	13
720		105	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125	59	43	28	7
722		93	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	20	53	98	86
Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	88	122	178	106
Biomass (tons)				4900	2609	9023	2809	2761	1426	4310	4241	9186	6015	13736	4681	5982	12146	5234	6033	3481	3888	1548	6614	1800
Lower limit				1960	1125	-24552	557	572	900	-434	-5549	-5569	3800	7922	2502	3632	4795	2955	280	1299	1936	625	UNK	2715
Upper limit				7837	4093	42602	5059	4947	1951	9051	14030	23942	8228	19549	6848	8360	19555	7519	11781	5664	5833	2471	UNK	9017

Table 4. Comparison of results from spring and fall research vessel surveys in 1990-94 for witch flounder in Div. 3NO with preliminary estimates for the srping of 1995.

Survey	Index	Div. 3N	Div. 3O	Total
Spring 1990a	Abundance ('000)	145	9293	9438
	Biomass (t)	83	6031	6114
Fall 1990	Abundance	489	11351	11840
	Biomass	434	8955	9389
Spring 1991	Abundance	672	5880	6552
	Biomass	263	3482	3745
Fall 1991	Abundance	957	3212	4169
	Biomass	777	2106	2883
Spring 1992	Abundance	501	6982	7483
	Biomass	216	3885	4101
Fall 1992	Abundance	1700	6026	7726
	Biomass	1267	3536	4803
Spring 1993	Abundance	826	3214	4040
	Biomass	448	1548	1996
Fall 1993	Abundance	1463	6711	8174
	Biomass	774	4033	4807
Spring 1994	Abundance	429	15304	15733
	Biomass	264	7107	7371
Fall 1994	Abundance	724	6476	7200
	Biomass	407	3480	3887
Spring 1995	Abundance	247	3430	3677
	Biomass	187	1800	1987

aNo strata deeper than 200 fm surveyed.

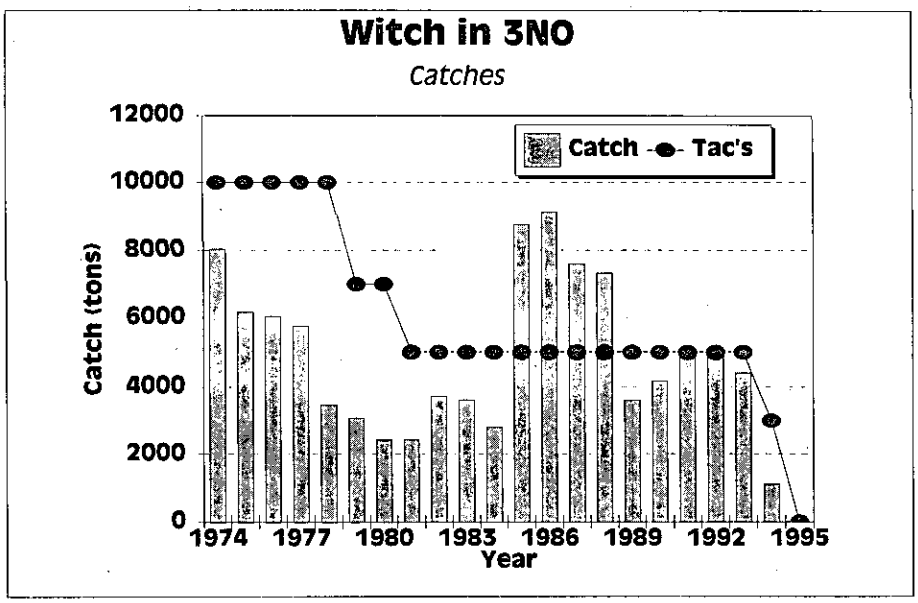

Fig. 1. Commercial catches of witch flounder in Div. 3NO from 1974-94 and TAC's 1974-95. The catch in recent years includes estimates of those non-reported.

***Note: Although a TAC of 3000 tons was agreed by the FC, it was also agreed that no directed fishing be conducted in 1994 due to the poor state of the stock.**

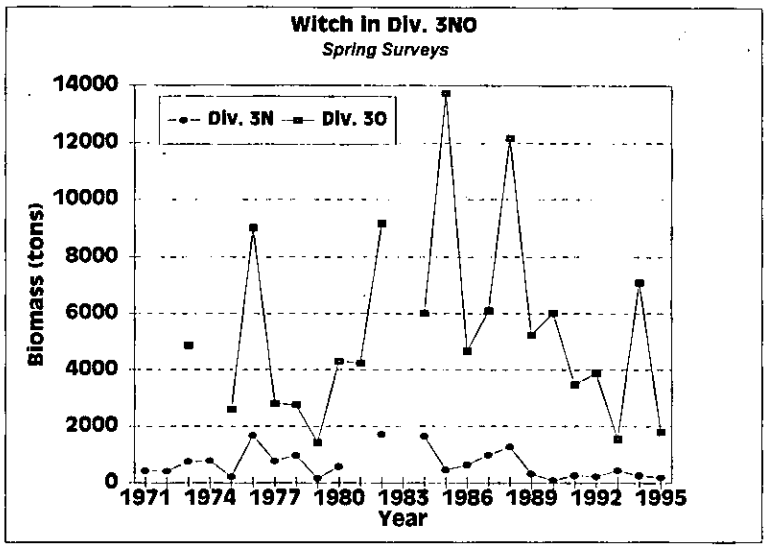

Fig. 2 Biomass estimates of witch flounder in Div. 3NO from Canadian spring surveys during 1971-95.

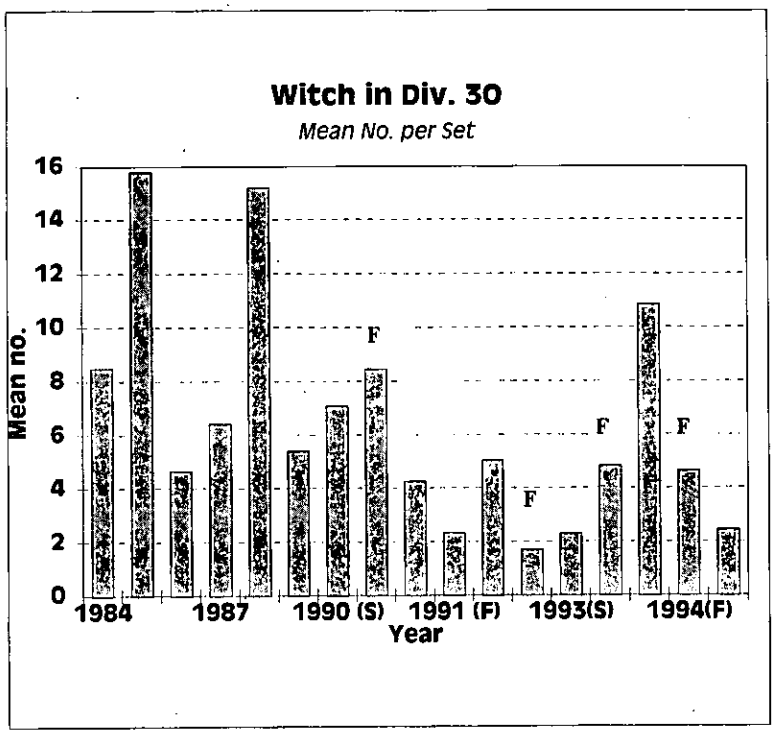

Fig. 3 Mean number per set of witch flounder from Canadian research vessel surveys in Div. 3O during 1984-95 (S = spring, F = fall).