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The Effect of Misreported Catches in the Assessment of the Flemish Cap Cod Stock: a Simulation Exercise

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Introduction

The information related to the assessment of the Flemish Cap cod stock, based in VPA's and survey indices, has been presented over the past through quite a long list of SCR documents. During last June meeting of the NAFO Scientific Council two working papers were presented in order to get an overall view of the trends in the abundance and biomass of this stock, during the last three decades (Serchuk, NAFO SC W.P. 90/27; de Cárdenas and Avila de Melo, NAFO SC W.P. 90/33).

From Fig. 1 of Serchuk Wp., reprinted here also as Fig.1, it is clear that three time periods can be considered in the recent history of this cod fishery: the first one up to 1979, without TAC's or a high TAC level of 40.000 tons, where the nominal catches fluctuate freely; a second period, 1980-87, with a low TAC level of 13.000 tons where the nominal catches suspiciously stick to this level; and finaly the moratorium years, 1988-90, with 0 TAC, a few hundred tons of annual nominal catches and an estimated catch level, at least for 1989, of 40.000 tons (NAFO Sci. Counc. Rep. 1990).

Furthermore the inadequacy of sampling is recorded throughout the time period, with most of the years having for the fleets with the higher proportion of removals length frequencies and age data only for a few months, and even some years in the late sixties and early seventies where length and/or age data are simply not available(Wells, NAFO SCR Doc. 80/II/28; Wells, Vazquez and Borges 84/VI/94).

Although the magnitude of the bias introduced in the VPA's by the scarcity of biological data from the commercial catches is difficult to quantify, the level of error caused by unreported catches can be roughly estimated by a simulation technique.

Material and metods

An equilibrium catch at age matrix is produced for a period of 15 years, using the mean catches at age figures from 1972 to 79 (Wells et al. NAFO SCR Doc. 84/VI/94), and forcing the catches of the three last years to fall 2.3 times from the former level. This factor corresponds to the ratio recorded between the mean level of catches of the 1970-79 period, and the level of the 1980-87 aproved TAC(13.000 tons).

A first run of Pope cohort analysis, with terminal F's set at 1.0, has given a set of convergence F's that where then used in a second run as input of final F's.

Results and discussion

The equilibrium catches at age and F matrices are presented in Table 1. The abundance matrix, as well as the total and spawning abundance ratios between each year and the first depressed year of the the time period considered, are presented in Table 2.

The abundance ratios obtained by this simulation shows that, if there isn't a significant change in the exploitation pattern and in the age structure of the catches throughout a time series, a bias in the calculation of the abundance parameters of an exploited stock is expected to occur when the nominal catches start to be sistematically misreported, and its magnitude is at the same level of the misreporting.

The combined effect of misreported catches and the insuficient sampling of its length and age compositions, strongly jeopardise the use of cohort analisys to assess the status of the 3M cod and, in our opinion, should prevent the mixing of analytical and survey results in the assessment of the Flemish Cap cod, namely in the design of abundance trends.

As long as this status quo is going on, survey series along with cpue series, provided these are obtained by observers on board, are the only reliabble tools to be used in the assessment of this cod stock.

References

DE CARDENAS, E. and A. M. AVILA DE MELO. 1990. Changes in the abundance of the Flemish Cap cod: an aproach using surveys data. NAFO SC W.P. 90/33. 8p.

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CATCH MATRIX

Ages	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3	4210	4210	4210	4210	4210	4210	4210	4210	4210	4210	4210	4210	1830	1830	1830
4	8366	8366	8366	8366	8366	8366	8366	8366	8366	8366	8366	8366	3637	3637	3637
5	7515	7515	7515	7515	7515	7515	7515	7515	7515	7515	7515	7515	3267	3267	3267
6	2774	2774	2774	2774	2774	2774	2774	2774	2774	2774	2774	2774	1206	1206	1206
7	683	683	683	683	683	683	683	683	683	683	683	683	297	297	297
8	283	283	283	283	283	283	283	283	283	283	283	283	123	123	123
9	248	248	248	248	248	248	248	248	248	248	248	248	108	108	108
10	71	71	71	71	71	71	71	71	71	71	71	71	31	31	31
11	52	52	52	52	52	52	52	52	52	52	52	52	23	23	23
12	35	35	35	35	35	35	35	35	35	35	35	35	15	15	15

F MATRIX

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.15	0.20	0.28	0.13	0.13	0.13
4	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.43	0.43	0.45	0.52	0.77	0.41	0.41	0.41
5	0.81	0.81	0.81	0.81	0.81	0.82	0.83	0.84	0.87	0.90	0.98	1.35	0.81	0.82	0.81
6	0.82	0.82	0.82	0.82	0.82	0.83	0.85	0.87	0.90	0.98	1.08	1.37	0.82	0.82	0.82
7	0.48	0.48	0.48	0.48	0.48	0.48	0.49	0.51	0.54	0.57	0.70	0.89	0.48	0.48	0.48
8	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.39	0.41	0.45	0.49	0.71	0.38	0.38	0.37
9	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.72	0.79	0.92	1.15	0.67	0.67	0.66
10	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.46	0.54	0.75	0.40	0.40	0.40
11	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.73	1.02	0.57	0.57	0.57
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00

Table 1- Equilibrium catch and fishing mortality derived from the catches at age of cod taken in Flemish Cap from 1972 to 1979 (Wells et al. 1984), for a time series of fifteen years where the catches of the three last years have been underdeclared 2.3 times from the previous level.

ABUNDANCE MATRIX

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3	38326	38326	38224	38119	37959	37780	37263	36780	35830	32678	25658	19224	16492	16498	16531
4	27569	27569	27569	27486	27400	27269	27122	26699	26303	25525	22945	17198	11930	11847	11851
5	15002	15002	15002	15002	14933	14863	14756	14636	14290	13965	13329	11216	6511	6476	6408
6	5483	5483	5483	5483	5483	5427	5369	5282	5183	4900	4634	4113	2383	2374	2346
7	1979	1979	1979	1979	1979	1979	1933	1886	1814	1734	1502	1284	858	860	853
8	1003	1003	1003	1003	1003	1003	1003	965	927	868	802	612	434	434	436
9	565	565	565	565	565	565	565	565	534	503	455	401	245	244	244
10	238	238	238	238	238	238	238	238	238	213	187	148	104	103	102
11	131	131	131	131	131	131	131	131	131	131	110	89	57	57	57
12	61	61	61	61	61	61	61	61	61	61	61	44	26	26	26
(1)	2.32	2.32	2.32	2.31	2.30	2.29	2.26	2.23	2.17	1.98	1.56	1.17	1.00	1.00	1.00
(2)	2.31	2.31	2.31	2.31	2.30	2.29	2.27	2.23	2.19	2.06	1.78	1.39	1.00	1.00	1.00
(3)	2.30	2.30	2.30	2.30	2.30	2.29	2.27	2.23	2.18	2.09	1.96	1.67	1.00	1.00	0.99

(1) Recruitment ratio (2) Exploitable ratio (3) Spawning ratio

Table 2- Abundance derived from the equilibrium catches at age of cod taken from Table 1. Abundance ratios between each year and the first depressed year of the time period.

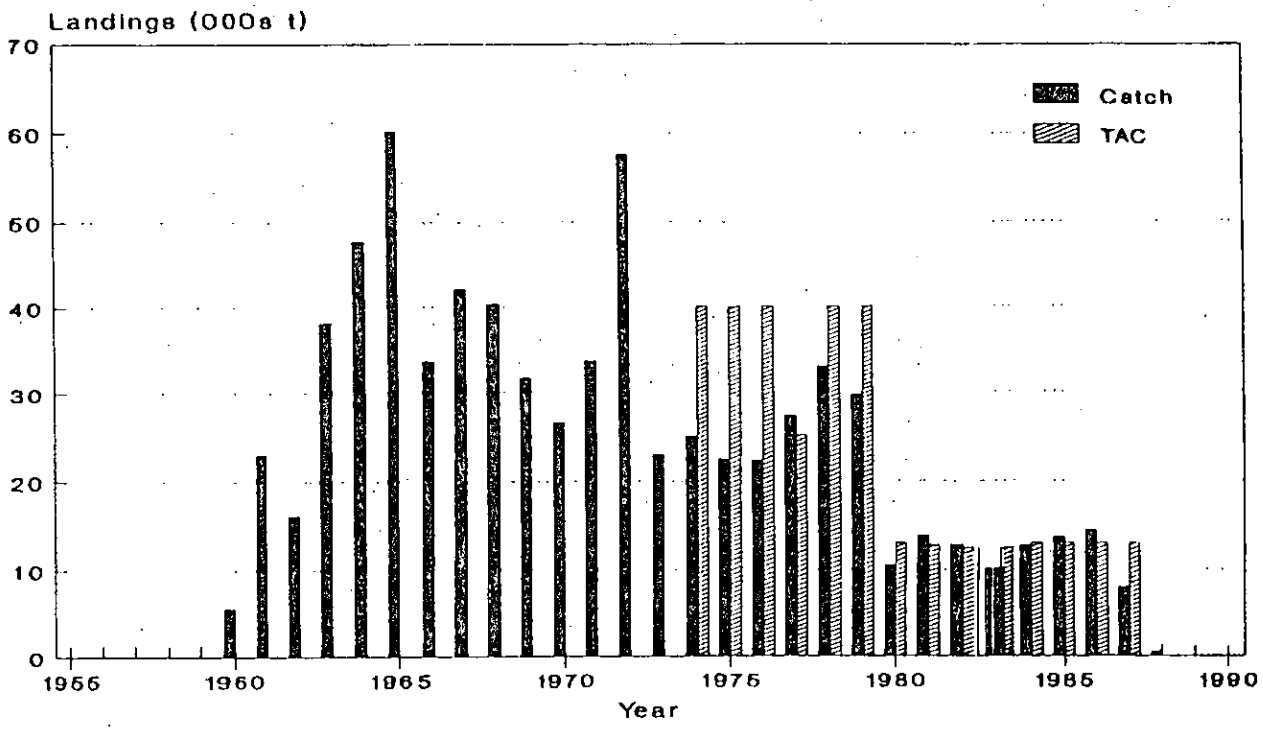

FIGURE 1. (Serchuk 1990)