NOT TO BE CITED WITHOUT PRIOR
REFERENCE TO THE AUTHOR(S)

Northwest Atlantic Fisheries Organization

Serial No. N4254 **NAFO SCR Doc. 00/25**

SCIENTIFIC COUNCIL MEETING – JUNE 2000

An Assessment of American Plaice (*Hippoglossoides platessoides*) in NAFO Division 3M.

by

R. Alpoim [1], A. Ávila de Melo [1]

[1] Instituto de Investigação das Pescas e do Mar, Av. Brasília 1400 Lisboa, Portugal.

Abstract

The present assessment evaluates the status of the 3M American plaice stock. The catch at age matrix, EU survey abundance at age and the respective mean weights were updated. The age 9 (1990 year-class) was the best represented in both catches and stock. The EU-survey indices for abundance, biomass and SSB declined to the lowest historical values in 1999. The two indices of F (C/B and F(6+/7+)) also show a declining trend during the series. This stock continues to be in a very poor condition, with only weak year-classes expected to be recruited to the SSB for at least five years. Although the level of catches since 1992 is extremely low, survey data indicate that this stock is kept at a very low level with no sign of recovery. The stock recruitment relationship show very poor recruitments for an SSB less than 6000 tons. The average of recruits at age 3 produced per Kg of SSB had also suffered a drastic decline since 1991.

Introduction

On Flemish Cap American plaice mainly occurs at depths shallower than 600 m. On this Division catches of Contracting Parties are mainly a by-catch of trawl fisheries directed to other species.

Since 1974, when this stock became regulated, catches ranged from 600 tons (1981) to 5 600 tons (1987). Catches declined to 275 tons in 1993, following the fast decline of the stock biomass and the 1992 reduction of the Spanish directed effort. Catch for 1999 was estimated to be 255 tons.

Since 1974 till 1993 a TAC of 2 000 tons has been in effect for this stock with the exception of 1978 (TAC of 4 000 tons). A reduction to 1 000 tons was agreed for 1994 and 1995, and finally a moratorium was agreed thereafter *(Fig.* 1).

Recent catches ('000 tons) are as follows:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TAC	2	2	2	2	2	2	2	2	1 [1]	1 [1]	0	0	0	0	0
Catch	3.8	5.6	2.8	3.5	0.8	1.6	0.8	0.3	0.7	1.3 [2]	0.3 [2]	0.2 [2]	0.3 [2]	0.3 [2]	

[1] No directed fishing.
[2] Provisional.

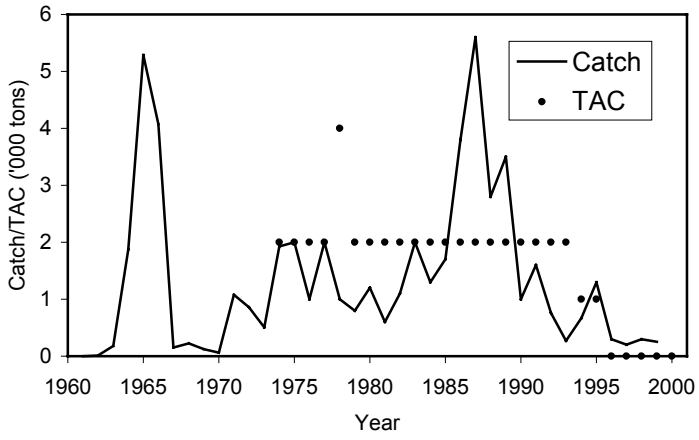

Fig. 1 . American plaice in Div.3M: nominal catches and agreed TAC's

Imput data

Commercial fishery data

Russia (Sigaev et al. 2000) provided length composition data for the 1999 trawl catches. This information was used to estimate the length and age compositions for the total catch (using the age/length key of the 1999 EU bottom trawl survey, Vazquez, 2000). The 1998 catches were extended till a plus group at age 16. Table 1 show the update of the catch at age matrix (De Cardenas, 1999). The 1990 year-class (age 9 in 1999) continues to be the most abundant one.

Table 1 . - Catch at age Matrix ('000)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1												
2												
3	34	188	11	14	15	27	5	21	10		0,3	
4	204	150	184	102	30	30	222	166	95		1	2
5	642	507	57	545	86	70	94	445	241	5	1	2
6	1161	998	95	288	282	86	77	368	350	14	6	6
7	790	1041	169	412	73	79	82	307	95	56	19	29
8	1003	499	229	363	148	39	289	217	82	13	47	60
9	289	446	156	222	133	23	28	183	40	30	29	64
10	93	231	69	63	62	19	55	22	47	24	20	35
11	24	169	10	7	36	2	19	36	10	38	25	40
12	52	40	2	3	19		19	52	8	13	28	21
13	55	20	2		22		22	41	10	3	12	10
14	14	8	1				46	24	8	10	12	5
15	27						46	32	5	4	6	3
16+										10	11	5

Mean weights-at-age in the catch shows a slowed decreasing trend from 1993 to 1997 for ages older than 8. This trend seems to stop in 1998 but in 1999 the mean weights-at-age decreased again, being actually slightly below the average (Table 2).

Table.2 Mean weight at age in the catch (Kg.)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Mean
1													
2								0,037		0,041			*0,039*
3	0,181	0,247	0,237	0,117	0,201	0,145	0,144	0,159	0,253	0,152	0,185		*0,184*
4	0,264	0,371	0,358	0,304	0,292	0,271	0,282	0,275	0,323	0,212	0,259	0,344	*0,296*
5	0,293	0,449	0,488	0,472	0,456	0,377	0,436	0,435	0,442	0,384	0,391	0,517	*0,428*
6	0,445	0,681	0,579	0,619	0,649	0,611	0,510	0,577	0,588	0,506	0,543	0,515	*0,569*
7	0,619	0,867	0,845	0,873	0,754	0,915	0,594	0,632	0,737	0,617	0,746	0,561	*0,730*
8	0,864	0,960	0,992	1,064	0,978	1,303	0,752	0,775	0,823	0,588	0,892	0,780	*0,898*
9	1,001	1,156	1,101	1,282	1,183	1,265	0,895	1,023	0,975	0,809	0,941	0,858	*1,041*
10	1,198	0,975	1,125	1,380	1,271	1,468	0,868	1,150	0,915	0,949	1,118	0,944	*1,113*
11	1,233	1,588	2,006	1,477	1,491	1,731	0,976	1,354	1,158	0,963	1,283	1,102	*1,363*
12	1,504		1,887	1,671	1,645		0,976	1,386	1,296	1,155	1,343	1,188	*1,405*
13	1,806		1,726		1,997		1,215	1,526	1,172	1,196	1,368	1,319	*1,481*
14	1,674		1,758				1,500	1,626	1,383	1,362	1,502	1,444	*1,531*
15								1,526	1,537	1,527	1,578	1,438	*1,521*
16+								1,709	1,330	1,435	1,622	1,388	*1,497*

Research survey data

The series of research surveys conducted by the EU since 1988 was continued in July 1999. The USSR-Russian survey series started in 1983 ending in 1993. A single Canadian survey was conducted in 1996.

A continuous decreasing trend in abundance and biomass indices was observed since the beginning of the EU survey series. The 1999 abundance and biomass were the lowest of the series. The USSR-Russian survey series, although more variable, also showed a decreasing trend between the 1986-93 period. Both indices from the Canadian survey in 1996 were at the same level of the EU survey (Fig. 2).

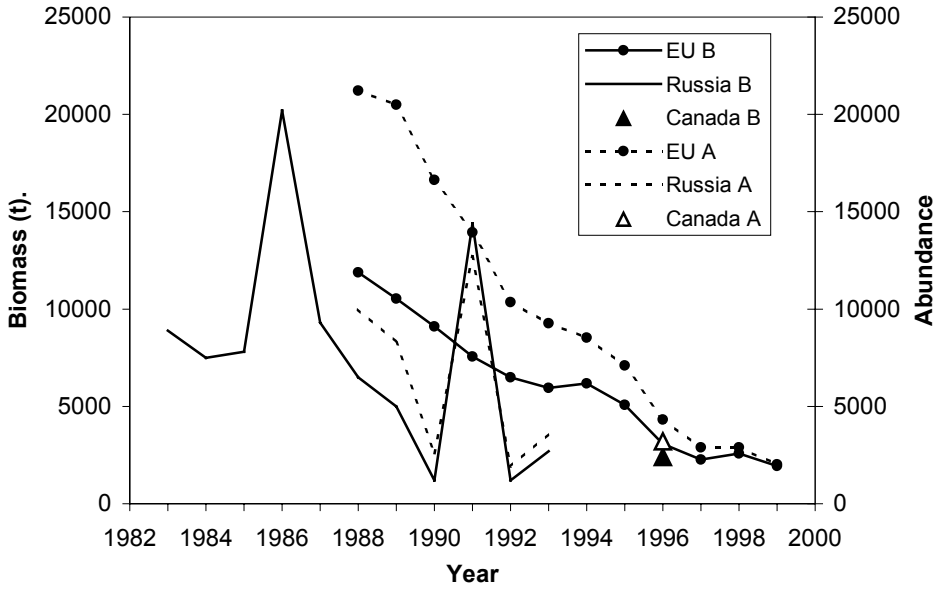

Fig. 2. American plaice in Div. 3M: trends in biomass and abundance in the surveys.

During the EU survey series the age reader was changed three times, and age compositions of the survey may reflect different criteria. As in the commercial catches age 9, corresponding to the 1990 year-class, was the best represented (Table 3). Since 1991, all the recruiting year-classes were very poor as shown by EU survey indices. Mean weight at age for this survey series is shown in table 4.

Table 3.- Numbers at age in the EU survey ('000)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1										7		6
2	2284	454	359	309	736	9	34	19	28	14	22	
3	625	6847	775	911	679	1365	40	99	103	96	29	20
4	3034	1500	7083	1877	910	969	1789	627	222	22	42	56
5	1975	3238	897	4461	1471	643	782	1620	465	99	62	60
6	3020	3006	2475	1836	3423	320	651	990	1236	311	202	57
7	4154	2868	1717	2009	913	3110	703	988	656	901	457	177
8	4258	1691	1657	1566	1090	339	2487	665	411	200	654	339
9	1492	587	1030	675	624	592	243	1132	308	312	388	371
10	207	261	485	232	289	296	480	128	470	223	267	189
11	109	34	90	8	138	198	166	143	113	372	235	260
12	61	14	15	48	74	229	164	119	63	103	228	163
13			31		16	280	195	119	67	19	73	98
14			17			865	398	241	90	77	94	100
15						28	397	183	62	38	47	49
16+						35	9	27	20	92	89	82

Table 4.- Weight at age in the EU-survey (kg)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Mean
1										0,013		0,007	*0,010*
2	0,036	0,074	0,046	0,045	0,049	0,046	0,052	0,037	0,049	0,041	0,077		*0,050*
3	0,057	0,144	0,122	0,119	0,139	0,140	0,106	0,159	0,169	0,152	0,154	0,146	*0,134*
4	0,261	0,314	0,275	0,250	0,258	0,265	0,305	0,275	0,298	0,212	0,233	0,284	*0,269*
5	0,319	0,485	0,407	0,406	0,441	0,363	0,500	0,435	0,421	0,384	0,344	0,393	*0,408*
6	0,472	0,624	0,577	0,542	0,592	0,528	0,557	0,577	0,538	0,506	0,463	0,496	*0,539*
7	0,657	0,823	0,711	0,723	0,660	0,669	0,771	0,632	0,657	0,617	0,597	0,515	*0,669*
8	0,832	0,969	0,854	0,853	0,842	0,691	1,002	0,775	0,769	0,588	0,724	0,721	*0,802*
9	0,963	1,236	1,013	1,101	1,073	0,736	1,227	1,023	0,883	0,809	0,770	0,794	*0,969*
10	1,130	1,411	1,064	1,087	1,121	0,820	1,217	1,150	0,816	0,949	0,973	0,944	*1,057*
11	1,257	1,765	1,419	1,387	1,263	0,861	1,343	1,354	1,033	0,963	1,176	1,119	*1,245*
12	1,334	2,125	1,721	1,805	1,324	0,884	1,287	1,386	1,315	1,155	1,259	1,211	*1,401*
13			1,712		1,763	1,022	1,384	1,526	1,238	1,196	1,452	1,381	*1,408*
14			1,610			1,165	1,423	1,626	1,406	1,362	1,428	1,629	*1,456*
15						1,754	1,491	1,526	1,567	1,527	1,523	1,477	*1,552*
16+						1,529	1,782	1,709	1,746	1,435	1,568	1,504	*1,610*

The EU survey spawning stock biomass (50% of age 5 and age 6 plus) was in 1994 at the 1989-90 level, but decreased since then (Table 5). In 1999 SSB dropped to 18% of the 1988 level, being the lowest point observed in the survey series (1988-99).

Table 5. Evolution of Recruit (‘000) and SSB (‘000 tons) EU survey index during the period 1988-99.

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988	1999
SSB	9.9	7.8	6.0	5.8	5.2	5.0	6.4	4.6	2.7	2.1	2.4	1.8
Age 3 recruits	625	6847	775	911	679	1365	40	99	103	96	29	20

Estimation of Parameters

Taking into account the deficiencies in the database, only an approximation of the trend in exploitation was obtained, by comparing the catch and survey biomass ratio for ages fully recruited to the fishery (ages 8-11). This index reached its lowest value in 1998, but in 1999 show a little increase though still at a low level (Table 6 and Fig. 3). This index could be affected by unreported catches. Another estimation of F could be obtained by the log ratio between ages 6+ and 7+ between consecutive years, minus natural mortality (0.2). This last index, although with high interannual variability, follows the same downward trend. For 1992, 1993 and 1997 this index gave negative values.

Table 6.- Trend 3M American plaice in F index

	Catch (tons)	Survey (tons)	C/B	F(6+/7+)
1988	1298	5350	0,243	0,691
1989	1470	2792	0,526	0,318
1990	497	3102	0,160	0,305
1991	768	2342	0,328	0,507
1992	435	2086	0,209	0,000
1993	111	1083	0,102	0,000
1994	309	3597	0,086	0,253
1995	429	2014	0,213	0,540
1996	161	1088	0,148	0,203
1997	91	940	0,097	0,000
1998	129	1308	0,099	0,203
1999	178	1008	0,177	

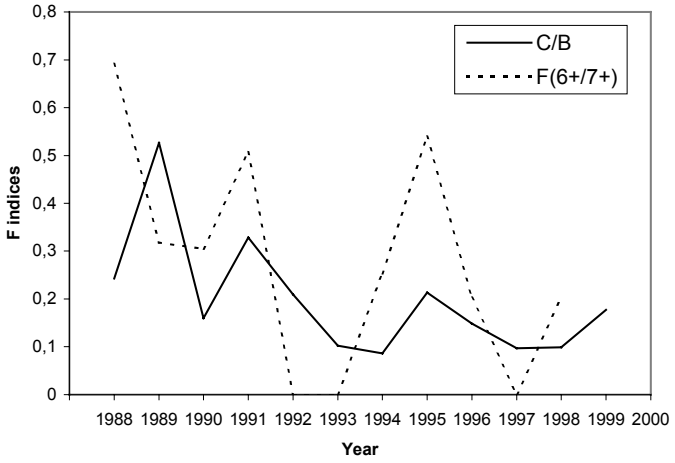

Fig. 3.- Comparison between the trends shown by two indices of F.

Assessment Results

This stock continues to be in a very poor condition, with only weak year-classes expected to be recruited to the SSB for at least five years. Although the level of catches since 1992 is extremely low, survey data indicate that this stock kept at a very low level with no sign of recovery.

Reference Points

The age 3 is the first age that appear in all the years of the EU survey series, so it was used to evaluate the spawning stock and recruitment relationship. Only 9 points are available (Fig.4), showing very poor recruitment for an SSB less than 6 000 tons.

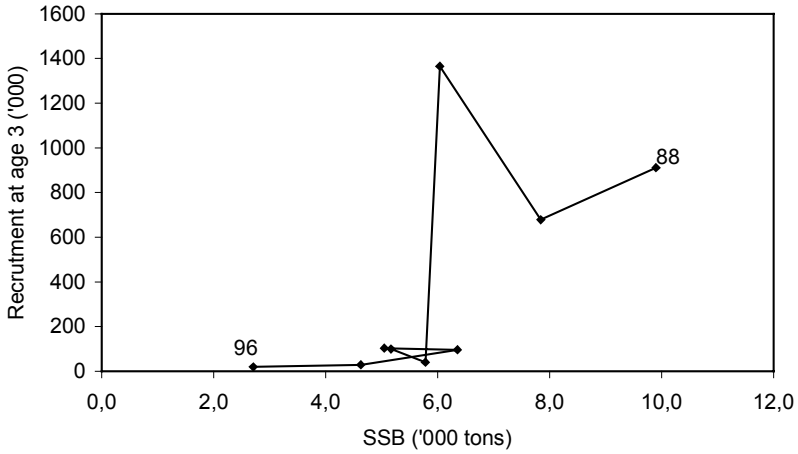

Fig. 4.- SSB-Recruitment scatter plot.

However, it is difficult to assess the effect of the environment on recruitment. In Fig 5 it is represented an index of the egg produced by Kg of SSB (both sexes includes), as the log of the R/SSB ratio for each year class. Two different periods can be shown in this figure, one before 1990 and other one since 1991. During the first period, an average of 0.135 recruits at age 3 were produced per Kg of SSB, while in the second period this average was reduced to only 0.013 recruits per Kg of SSB.

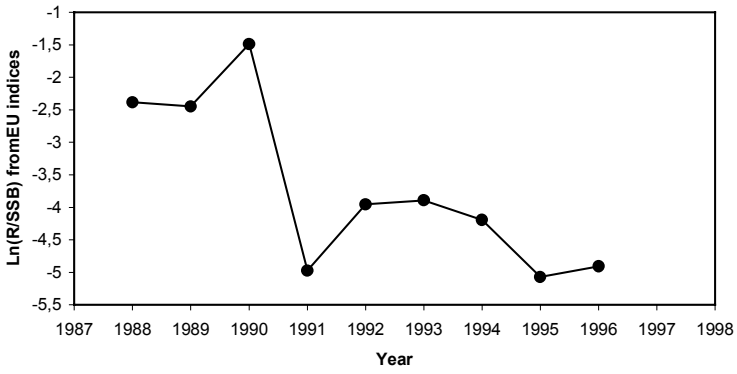

Fig. 5.- Recruit at age 3 produced per Kg of SSB index.

This recruitment failure seems not to be caused by the new shrimp fishery developed in Flemish Cap since the beginning of 90´s, because estimation of by-catch give a very low figures for American plaice (Kulka, 1999). Moreover, age 0 and 1seems to be not accessible to trawl gears as it happen in fact with the trawl gear used in the EU survey (Table 4).

The yield-per-recruit analysis is presented with the same parameters from the two last years (De Cárdenas and Junquera, 1998): M=0.2; the selectivity pattern coming from 3NO American plaice, the knife edge maturity of 50% of age 5 and age 6 plus and the average mean weights at age in the catch and the stock for the period 1988-99. This analysis give a $F_{0.1} = 0.28$.

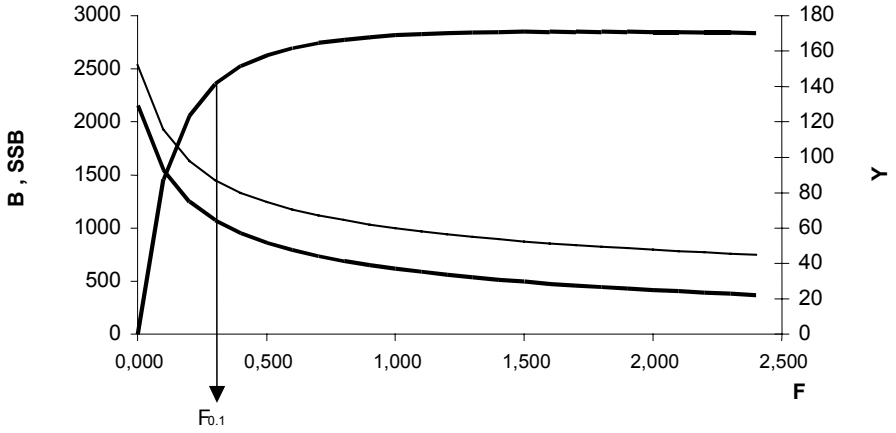

Fig. 6. – Yield, B and SSB per recruit curve for 3M American plaice.

References

De Cardenas, E.and S. Junquera- 1998. An assessment on American plaice (Hippoglossoides platessoides) in Division 3M. NAFO SCR Doc. 98/51. N3042. 7p.

De Cardenas, E.- 1999. An assessment on American plaice (Hippoglossoides platessoides) in Division 3M. NAFO SCR Doc. 99/39. N4098. 7p.

Kulka, D. W. – 1999. Update on the By-catch in the shrimp fisheries in Davis Strait to Flemish Cap. NAFO SCR Doc. 99/96. N4168. 15p.

Sigaev, I.K., V.A. Rikhter, P.S. Gasiukov, Vaskov, A.A., Igashov, T.M. and Kiseleva, V.M. - 2000. Russian research report for 1999. NAFO SCS Doc. 00/9. N4221. 22p.

Vazquez, A.-2000. Results from the bottom trawl survey on Flemish Cap of July 1999. NAFO SCR Doc. 00/9. N4228. 50p.