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American plaice in NAFO Subarea 2 & Division 3K

by

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### Abstract

Because of a limited amount of data on commercial fishing effort and a short series of research vessel surveys, no Virtual Population Analysis was attempted for this stock. Total mortality estimates for 1982 from commercial and research data gave varying results. Commercial catch per unit effort has been stable in recent years, except for a sharp increase in 1981 when a large directed fishery occurred. Research vessel surveys showed an increase in abundance in Div. 2J in 1982 while estimates of abundance for Div. 3K have been relatively stable since 1979. The assessment indicated that the stock appears to be in good condition and continuation of the 10,000 t TAC for 1984 is recommended.

### Résumé

Un volume limité de données sur l'effort de pêche commerciale et une série de relevés par navires de recherche trop courte nous ont empêché de mener une analyse de population virtuelle de ce stock. Les estimations de mortalité totale en 1982, fondées sur les données des bateaux de pêche commerciale et des navires de recherche ont donné des résultats variables. Les prises commerciales par unité d'effort ont été stables ces dernières années, à l'exception d'une abrupte augmentation en 1981, alors qu'il se pratiqua une importante pêche dirigée de cette espèce. Les relevés par navires de recherche ont indiqué une augmentation d'abondance dans la div. 2J en 1982, alors que les estimations d'abondance dans la div. 3K ont été relativement stables depuis 1979. Le stock, d'après l'évaluation, semble en bon état, et on recommande que le TPA de 10 000 t soit maintenu en 1984.

### Landings

Up to 1975-76 most of the landings were by the European fishing fleet and Canadian participation was almost exclusively by the Newfoundland inshore sector (Table 1). Since 1976 this fishery has become almost entirely Canadian and the emphasis, especially in 1977, 1980, and 1981 has been on the offshore fishery. However, offshore landings appear to be related to the availability of cod allocations to the trawler fleet during winter and early spring.

### Catch and effort

Data on catch and effort has only become available since the Canadian offshore fishery began in 1976, however, the amount of directed catch has fluctuated hence a reliable series of catch and effort is not available (Table 2).

### Sampling data

Sampling in 1982 appears to have been adequate, considering the relatively small catch of about 1,870 t. Approximately 2,600 fish were measured and 689 otoliths collected from a total of 8 commercial samples (Table 3).

### Numbers and weights at age for 1982

Numbers and weight at age were calculated from the commercial sampling data using quarterly age length keys, monthly length frequencies and commercial landings when available (Table 4). The complete catch matrix (numbers landed at age) and average weights at age are given in Table 5.

### Research vessel survey data

Numbers at age (Div. 2J and 3K combined), total population size (numbers) with 95% confidence limits (1977-82) and total biomass for Div. 2J and 3K

(1978-82) are given in Tables 6, 7, and 8 respectively. There appears to have been an increase in population numbers in Div. 2J in 1982 (Table 7) and also the total biomass (Table 8) has increased to the 1978 level, principally because of the increase in Div. 2J. It should be pointed out, however, that nearly all of the commercial landings come from Div. 3K.

### Calculation of total mortality rates

Total mortality rates were calculated from survival rates using research survey population numbers 1981-82 (Table 9) and from a catch curve calculated from the catch matrix 1979-82 (Fig. 1).

For the 1981-82 population numbers there was a fairly wide range of estimates of instantaneous total mortality depending on which age was considered to be fully recruited. Previous assessments suggested that plaice in this stock were not fully recruited until age 14. However, the catch curve (Fig. 1) suggests full recruitment at age 12. Total mortality (Z) from the research data (Table 9) indicated rather low values for Z, i.e. 0.339 for ages 11+ and 0.19 for ages 12+. These values apparently represent survival during 1982 since the surveys occurred in late November and early December in both years (1981 and 1982). Natural mortality is assumed to be 0.2.

The catch curve gave a Z value of 0.564, indicative of instantaneous total mortality over the previous several years.

### Stock assessment

In 1981 a VPA was attempted on this stock, however, there was some difficulty in determining a terminal F because of the limited amount of commercial effort and research vessel survey data. In 1981 there was a fairly substantial offshore fishery for plaice in Div. 3K, especially January-March, however, in 1982 and again in 1983, with changes in the methods of cod allocation, catches of plaice for the period were drastically reduced, from around 5,000 t in 1981 to 480 t in 1982 to about 200 t in 1983.

At the 1982 Groundfish meeting it was agreed that results from attempted VPA runs were unreliable and the 1982 TAC of 10,000 was recommended for 1983. This advice was also retained for 1984.

$F_{0.1}$  for this stock has been calculated at 0.32 (Brodie & Pitt 1982). It seems highly unlikely that the TAC of 10,000 will be reached in 1983 and it seems evident that the amount of effort by the otter trawler fleet will be determined by the availability of cod allocations to this component.

### Reference

- Brodie, W. B., and T. K. Pitt. 1982. Stock assessment update of American plaice in NAFO Subarea 2 - Division 3K. CAFSAC Res. Doc. 82/32.

Table 1. Nominal catches and TAC's (t), American plaice, NAFO Subarea 2, and Division 3K, 1967-1982.

Year	Inshore	Canada offshore	Total	Poland	USSR	Other	Total	TAC
1967	395		395	1,134	1,701	414	3,644	
1968	1,023		1,023	1,889	2,911	128	5,951	
1969	1,689		1,689	867	4,129	217	6,902	
1970	3,751		3,751	378	8,160	397	12,686	
1971	2,486		2,486	233	2,597	32	5,348	
1972	1,188	9	1,197	849	6,760	317	9,123	
1973	1,368	16	1,384	225	3,011	520	5,140	
1974	462	106	568	91	4,643	308	5,610	10,000
1975	813	46	859	95	4,449	345	5,748	8,000
1976	1,741	736	2,477	118	3,373	131	6,099	8,000
1977	1,925	4,691	6,616	27	702	162	7,507	8,000
1978	1,723	1,452	3,175	138	123	86	3,522	6,000
1979	1,792	1,063	2,855	31	39	53	2,978	6,000
1980	1,149	3,728	4,877	39	26	91	5,033	6,000
1981	1,022	6,332	7,354	-	56	30	7,440	6,000
1982	586	1,264	1,850	12	7	-	1,869	10,000

Table 2. Catch and effort, offshore trawlers, American plaice, Subarea 2 and Division 3K.

Year	Total Catch (t)	Directed CPUE (t/hr)	Effort (hr) (calculated)	Directed catch (t)
1976	6,099	(0.395)	15,440	701
1977	7,507	0.402	18,674	3,628
1978	3,522	0.375	9,392	652
1979	2,978	0.467	6,377	315
1980	5,033	0.525	9,587	2,151
1981	7,440	0.970	7,670	4,998
1982 (a)	1,869	0.505	3,700	500

<sup>a</sup>Preliminary.

Table 3. List of Commercial Sampling by quarter and division available for 1982, American plaice NAFO Subarea 2+Division 3K provided by the St. John's Commercial Sampling Section.

Qtr	<u>Measurements</u>			<u>Otoliths</u>			<u>Catch(t)</u>			<u># Samples</u>		
	<u>2H</u>	<u>2J</u>	<u>3K</u>	<u>2H</u>	<u>2J</u>	<u>3K</u>	<u>2H</u>	<u>2J</u>	<u>3K</u>	<u>2H</u>	<u>2J</u>	<u>3K</u>
1	-	-	404	-	-	87	-	67	413	-	-	1
2	-	-	1748	-	-	482	4	95	556	-	-	5
3	289	-	100 <sup>1</sup>	86	-	34 <sup>1</sup>	60	12	119 <sup>1</sup> 23	1	-	1 <sup>1</sup>
4	-	-	-	-	-	-	-	3	343 <sup>1</sup> 8	-	-	-

<sup>1</sup> Inshore-fixed gear

Table 4. Average weight and numbers of plaice caught at age for the commercial fishery in NAFO Divisions 2J & 3K, 1982.

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<u>AGE</u>	<u>WEIGHT</u>	<u>CATCH</u>	<u>VAR(CATCH)</u>	<u>STD, ERROR</u>	<u>COEF, VAR</u>
6	0.330	10	54.618	7.39	0.71
7	0.380	64	435.146	20.86	0.32
8	0.425	201	1424.931	37.75	0.19
9	0.567	393	2472.918	49.73	0.13
10	0.567	673	4179.324	64.65	0.10
11	0.690	651	3604.496	60.04	0.09
12	0.870	352	1531.471	39.13	0.11
13	1.114	232	667.679	25.84	0.11
14	1.429	113	245.444	15.67	0.14
15	1.676	57	118.507	10.89	0.19
16	1.874	23	46.010	6.78	0.29
17	2.490	5	8.421	2.90	0.55
18	2.073	5	10.036	3.17	0.63

Table 5. Catch (numbers  $\times 10^{-3}$ ) and average weight (kg) matrices for American plaice in NAFO Subarea 2+Division 3K 1976-1982.

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AM, PLAICE 2+3K CATCH MATRIX

AGE	1976	1977	1978	1979	1980	1981	1982
7	1544	403	132	201	83	1	64
8	1861	1026	277	858	231	23	201
9	1317	1481	500	1791	772	121	393
10	1492	1657	830	1467	2158	456	673
11	1322	1430	1153	901	1751	1449	651
12	1240	1435	1134	389	1682	3070	352
13	964	911	974	219	1097	2665	232
14	259	677	474	92	502	1452	113
15	138	430	259	21	253	934	57
16	54	349	186	6	173	700	23
17	39	140	65	10	46	245	5
18	27	84	57	1	33	154	5
19	13	17	9	1	8	25	1

AM, PLAICE 2+3K WEIGHT MATRIX

AGE	1976	1977	1978	1979	1980	1981	1982
7	0.293	0.293	0.226	0.268	0.351	0.241	0.380
8	0.336	0.336	0.272	0.297	0.333	0.258	0.425
9	0.423	0.423	0.317	0.374	0.372	0.289	0.567
10	0.511	0.511	0.392	0.484	0.373	0.344	0.567
11	0.619	0.619	0.514	0.647	0.456	0.375	0.690
12	0.756	0.756	0.580	0.882	0.576	0.468	0.870
13	0.939	0.939	0.778	1.189	0.790	0.588	1.114
14	1.239	1.239	1.011	1.381	0.935	0.780	1.429
15	1.402	1.402	1.205	1.959	1.163	1.071	1.676
16	1.643	1.643	1.371	1.960	1.278	1.348	1.874
17	1.852	1.852	1.639	1.815	1.730	1.623	2.490
18	2.088	2.088	1.690	1.960	2.055	1.955	2.073
19	2.364	2.364	2.184	2.000	2.347	2.605	2.490



Table 6. American plaice numbers at age for selected strata from research vessel surveys in NAFO Divisions 2J+3K.

Age	<u>Numbers X 10<sup>-3</sup></u>				
	1978	1979	1980	1981	1982
3				306	722
4	4,144	1,405	172	1,393	1,388
5	21,462	8,775	2,082	6,084	6,787
6	35,365	20,916	4,430	30,275	18,356
7	38,916	34,638	33,563	50,135	50,603
8	31,469	23,966	28,371	48,430	60,393
9	30,113	16,183	16,073	22,527	58,413
10	17,794	9,703	11,946	19,735	26,620
11	9,138	4,003	9,418	6,505	12,076
12	9,694	7,385	6,922	6,255	6,961
13	7,540	3,209	3,501	2,574	4,617
14	3,457	1,233	1,413	1,047	2,105
15	3,472	328	539	640	641
16	1,377	151	204	447	108
17	351	-	211	-	10
18	131	-	-	64	-
Total 7+	153,452	100,799	112,161	158,359	222,547

Table 7. Population size (with upper and lower 95% confidence limits) for American plaice 4 years and older for selected strata from fall research vessel surveys.

Year	<u>Division 2J</u>			<u>Division 3K</u>		
	<u>(Upper)</u>	<u>Mean</u>	<u>(Lower)</u>	<u>(Upper)</u>	<u>Mean</u>	<u>(Lower)</u>
Numbers X 10 <sup>-6</sup>						
1977	(153.3)	178.4	(103.5)	-	-	-
1978	(148.8)	110.2	(72.1)	(142.7)	105.8	(69.0)
1979	(89.2)	80.2	(71.2)	(64.4)	51.9	(39.4)
1980	(116.4)	89.1	(61.8)	(76.3)	59.3	(42.2)
1981	(160.6)	118.6	(76.6)	(96.6)	77.6	(58.7)
1982	(226.4)	195.0	(123.6)	(65.1)	54.4	(43.7)

Table 8. Biomass estimates for American plaice from random stratified surveys in NAFO Divisions 2J and 3K 1978-1982. The same strata were used for each year.

Division	1978	1979 Tons X 10 <sup>-3</sup>	1980	1981	1982
2J	56,882	36,788	55,974	63,101	88,996
3K	57,314	31,354	32,480	37,807	26,455
TOTAL	114,196	68,142	88,454	100,908	115,451

Table 9. Calculation of survival and total mortality rates from American plaice population numbers derived from random stratified surveys in NAFO Divisions 2J and 3K - November-December 1981 and 1982.

Age	Pop. # X 10 <sup>-3</sup>				
	1981	1982			
4	1,393	1,388			
5	6,084	6,787	$\Sigma$ 9-18 (1982)	111,551	S=1.031
6	30,275	18,356	$\Sigma$ 8-17 (1981)	108,160	Z=-0.031
7	50,135	50,603			
8	48,430	60,393			
9	22,527	58,413			
10	19,735	26,620	$\Sigma$ 10-18 (1982)	53,138	S=0.890
11	6,505	12,076	$\Sigma$ 9-17 (1981)	59,730	Z=0.117
12	6,255	6,961			
13	2,574	4,617			
14	1,047	2,105	$\Sigma$ 11-18 (1982)	26,518	S=0.713
15	640	641	$\Sigma$ 10-17 (1981)	37,203	Z=0.339
16	447	108			
17		10	$\Sigma$ 12-18 (1982)	14,442	S=0.827
18	64	-	$\Sigma$ 11-17 (1981)	17,468	Z=0.190

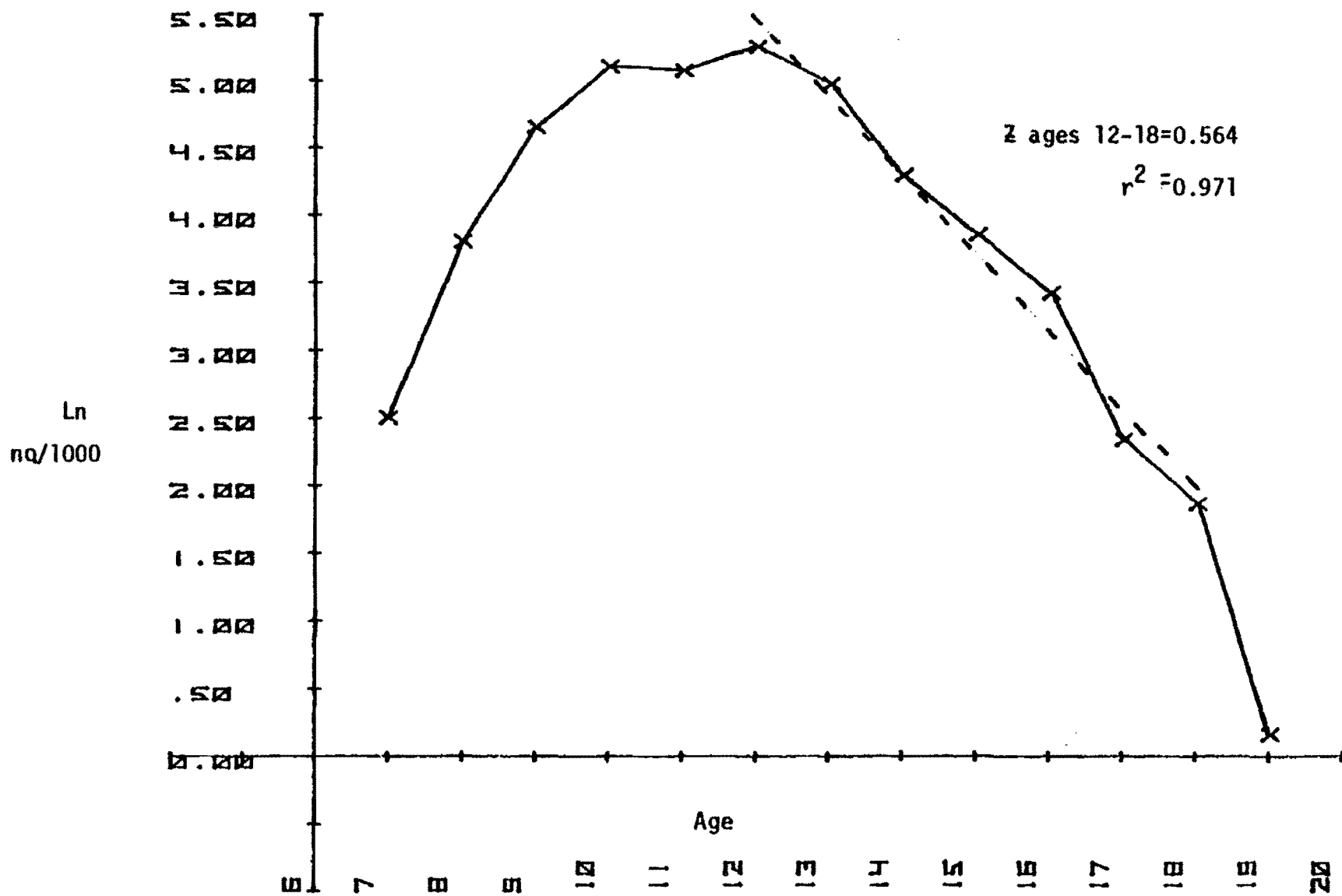


Fig. 1. Catch curve of American plaice in Subarea 2+Division 3K using commercial catch at age data from 1979-82.