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Roundnose Grenadier in NAFO SA 0+1 and 2+3

by

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Introduction

The nominal catches of roundnose grenadier in NAFO Subareas 0+1 continue to be below 100 t. Preliminary data indicate that only 1 t was taken in 1987 (Table 1, Fig. 1), but this may be related to incomplete statistics at this point in time. Most of the catch in recent years has been taken in the Greenland fishery as by-catch (Table 2a) throughout most of the year (Table 3a). In 1986 most of the catch was taken during April-May. As has been noted previously (Atkinson and Power MS 1987) the nature of the fishery in recent years (by-catch only) has precluded any update of the previous general production analysis of catch and effort data (Atkinson MS 1985).

Prior to 1979, nominal catches from the Subareas 2+3 stock averaged about 22,500 t (excluding the catch of 75,445 t in 1971) but from 1979 to the present, landings have remained below 10,000 t (Table 1, Fig. 2). They bottomed out at an all time low of about 2000 t in 1980 then increased to about 7000 t in 1981 before declining again to about 4000 t in 1983 and 1984. They have gradually increased since then and provisional data for 1987 indicate landings above 8000 t in 1987. Higher catches by both the USSR and the German Democratic Republic account for some of this increase, while a reported catch of 1001 t by EEC countries in 1987 is the highest in recent years (Table 2b). Catches continue to be taken in the second half of the year (Table 3b). There are insufficient data available in Canada to carry out an analytical assessment of this stock. In recent years, surplus production models have not been employed in the assessments because the relationships between CPUE and effort have had positive slopes (Atkinson and Power MS 1987).

Methods and Results

Commercial catch and effort data for the SA 2+3 stock were obtained from ICNAF/NAFO Statistical Bulletins for the period 1967 to 1985 and combined with preliminary NAFO statistics for 1986 to derive one database then analysed using a multiplicative model (Gavaris 1980). In addition, commercial catch and effort data collected by Canadian observers for the period 1978 to 1987 were combined and analysed also using a multiplicative model. Unlike previous analyses, data from side and stern trawlers were kept separate. Whereas the ICNAF/NAFO data are aggregated on a monthly basis selecting only those catches where the roundnose grenadier catch was >50 % of the total, the observer data were aggregated on a trip-by-trip basis after selecting only those sets where the catch of roundnose grenadier constituted >50% of the total. For the ICNAF/NAFO dataset, any data points that represented <10 units of either catch or effort were deleted because of possible biases due to rounding errors. Because the observer data could be broken out to tenths of tonnes, only those catches and effort of less than 1/10 t were deleted because of possible bias through rounding. Analysis using the ICNAF/NAFO dataset was not weighted because of possible pro-rating of effort data as noted in the past (Atkinson and Power MS 1987). Because there is not pro-rating in the observer data, weighting by ln effort was carried out.

The results (Tables 4a and 4b) indicate that the regressions are significant. Results using the ICNAF/NAFO database reveal that the model explained about 44% of the variation in the data. The model explained only about 28% of the variation in the observer data. With the ICNAF/NAFO data, there were not significant differences with regard to the month categories and division categories but the data were not combined because this did not result in improved relationships. Differences in the country-gear-TC categories were marginally significant because of USSR-OTM-TC7 which had a significantly higher coefficient than the other categories. Once again, no categories were grouped. Only the years 1981 and 1985 were found to be significantly different from the standard (1967). With the observer data, the different category types were all significant, although only marginally so, and because of a few points only: Poland-OTB-TC7, Div. 2J, December, and 1980 and 1984.

According to ICNAF/NAFO statistics, effort peaked in 1971 (Table 5a, Fig. 3a and 4a) then gradually declined to an all time low in 1980. It rose again in 1981 but then declined slightly until 1984. Since then it has gradually increased again. Catch rates were highest over the 1967-1986 period in 1970 and 1973 after which they declined until 1981. Since then, catch rates have remained fairly stable.

The results from the observer data (Table 5b, Fig. 3b and 4b) indicate a drop in effort from 1978 to 1980. Effort has remained low but gradually increased from 1984 to 1987. Catch rates have fluctuated between years but show no real trend with time. Catch rates have been stable over the period covered by these data except for 1980 and 1984 when increases occurred. It is not thought that these increases reflect changes in the stock.

When compared, the two catch rate series show similar overall trends with time although the results using observer data show more inter-annual fluctuations than do those from the ICNAF/NAFO data. (Fig. 5).

It has been noted in the past (Atkinson and Power MS 1986, MS 1987) that surplus production analyses could not be carried out on the SA 2+3 data because the slopes of the regressions of CPUE on effort (lagged 4 and 6 years (Gulland 1961)) were positive. Because of this, general production analysis was not carried out this year. Since the longer time series shows significant differences in years for 1981 and 1985 only, it was felt that there was insufficient contrast in the catch rate series over time for general production analyses to be useful.

Discussion

As noted in the introduction, the fishery for roundnose grenadier in SA 0+1 has only been by-catch since about 1980, and it is not possible to update the general production analysis presented previously. Therefore, there are no data available to indicate any change in the advised catch at 2/3 f_{MSY} of 8000 t.

The database available for roundnose grenadier in SA 2+3 is inappropriate for surplus production analyses because there is insufficient contrast in catch rates over time. Catch rates have been stable since about 1979, a period when catches have averaged about 5000 t. It has been noted in the past that by-catch limitations of Greenland halibut may be restricting this fishery and thus catch rates in the most recent period may not be reflective of stock status. However, there are insufficient data available to suggest any change in the TAC in SA 2+3 for 1989 from the present level of 11,000 t.

References

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Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Can. J. Fish. Aquat. Sci. 37: 2272-2275.

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Table 1: Summary of nominal catches (t) of roundnose grenadier by Subarea and Division.

Year	0	1	Total	TAC	2G	2H	2J	3K	Other	2+3	TAC
1967	1,129	6	1,135		-	868	217	16,009	210	17,304	
1968	5,996	284	6,280		2,536	4,089	479	23,553	606	31,263	
1969	2,642	68	2,710		387	-	264	11,682	-	12,333	
1970	545	5,980	6,525		-	-	468	22,267	129	22,864	
1971	4,172	4,132	8,304		54,179	2,738	81	18,392	55	75,445	
1973	5,783	2,311	8,094		2,161	655	293	21,122	155	24,386	
1972	1,054	3,830	4,884		5,880	232	632	10,655	165	17,564	
1974	2,661	9,657	12,318		3,220	2,007	333	22,816	40	28,416	32,000
1975	204	4,749	4,953	10,000	6,489	3,536	1,754	15,388	258	27,425	32,000
1976	2,610	5,893	8,503	14,000	3,841	1,460	1,381	13,636	275	20,593	32,000
1977	721	2,214	2,935	8,000	2,597	525	206	11,935	123	15,386	35,000
1978	-	5,839	5,839	8,000	3,112	1,412	913	15,250	15	20,702	35,000
1979	106	6,815	6,921	8,000	1,035	3,090	438	3,200	18	7,781	35,000
1980	32	1,721	1,753	8,000	279	493	726	451	104	2,053	30,000
1981	87	392	479	8,000	967	1,693	463	3,920	42	7,085	27,000
1982	43	48	91	8,000	719	734	182	2,709	-	4,344	27,000
1983	46	22	68	8,000	140	1,390	36	1,916	87	3,569	11,000
1984	25	25	50	8,000	107	289	3	3,362	112	3,873	11,000
1985	16	39	55	8,000	-	80	13	4,642	213	4,948	11,000
1986*	1	80	81	8,000	-	117	56	7,222	31	7,426	11,000
1987*			1	8,000						8,229	11,000
1988				8,000							11,000

* Provisional.

Table 2a: Nominal catches (t) of roundnose grenadier in Subarea 0+1 by country and year.

Country	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986*	1987*
Denmark (G)	1	10	32	21	-	39	37	22	25	36	81	-
GDR	181	61	-	-	-	-	-	-	-	14	-	-
FRG	147	519	5,807	6,794	1,721	353	11	-	-	-	-	-
USSR	8,174	2,345	-	106	32	87	43	46	25	2	1	1
Japan	-	-	-	-	-	-	-	-	-	3	4	-
TOTAL	8,503	2,935	5,839	6,921	1,753	479	91	68	50	55	86	1

* Provisional.

Table 2b: Nominal catches (t) of roundnose grenadier in Subarea 2+3 by country and year.

Country	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986*	1987*
Canada (M)+	-	-	2	-	-	-	-	-	-	-	8	10
Canada (N)	16	15	7	4	-	-	-	-	-	-	-	10
FRG	1	174	973	-	32	-	-	-	23	178	13	-
GDR	497	613	1,801	480	898	1,407	1,640	2,586	3,650	3,740	4,571	4,473
Poland	101	-	51	96	36	18	15	50	51	12	17	-
Romania	-	7	108	-	-	-	-	-	-	-	-	-
USSR	19,978	14,577	17,760	7,201	1,087	5,660	2,689	933	147	1,018	2,801	2,658
Japan	-	-	-	-	-	-	-	-	2	-	13	77
EEC	-	-	-	-	-	-	-	-	-	-	-	1,001
Portugal	-	-	-	-	-	-	-	-	-	-	3	-
TOTAL	20,593	15,386	20,702	7,781	2,053	7,085	4,344	3,569	3,873	4,948	7,426	8,229

* Provisional.
+ Maritimes and Quebec were combined prior to 1979.

Table 3a: Nominal catches (t) of roundnose grenadier in Subarea 0+1 by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	
1976	475	7	1	197	-	-	-	206	631	1,793	3,276	1,917	8,503	
1977	464	94	20	14	2	5	58	1,094	1,089	38	18	39	2,935	
1978	139	130	723	2,554	1,943	343	4	2	1	-	-	-	5,839	
1979	605	759	348	626	1,658	1,122	123	118	1	185	545	831	6,921	
1980	686	385	-	-	-	-	-	418	117	118	23	6	1,753	
1981	1	4	13	12	1	2	-	-	170	245	17	8	479	b
1982	1	3	9	6	4	11	1	3	-	14	25	7	91	a
1983	-	3	6	5	1	-	-	-	7	5	21	14	68	b
1984	-	2	6	8	1	1	-	14	14	2	-	2	50	
1985	1	6	8	6	3	1	-	-	5	2	19	4	55	
1986*	3	3	8	44	11	2	4	1	2	2	2	3	86	c
1987*	-	-	-	-	-	-	1	-	-	-	-	-	1	

* Provisional.
a includes catch of 7 t from month 'unknown'.
b includes catch of 6 t from month 'unknown'.
c includes catch of 1 t from month 'unknown'.

Table 3b: Nominal catches (t) of roundnose grenadier in Subarea 2+3 by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	
1976	843	1,225	1	605	290	106	257	1,856	1,170	3,961	4,530	5,749	20,593	
1977	44	8	12	45	13	6	1,776	5,698	3,411	1,973	1,681	719	15,386	
1978	264	467	13	45	7	405	6,416	3,963	1,814	3,964	1,478	1,866	20,702	
1979	103	32	44	6	136	683	1,169	1,612	1,691	611	745	949	7,781	
1980	3	4	48	13	2	-	-	130	376	794	577	106	2,053	
1981	40	14	1	2	4	1	168	1,636	1,391	759	1,751	1,318	7,085	
1982	4	-	3	5	3	4	559	563	410	698	1,465	630	4,344	
1983	3	18	4	-	3	1	1	74	1,292	861	866	446	3,569	
1984	31	13	6	19	-	5	-	45	460	3,018	123	153	3,873	
1985	44	7	1	96	73	-	54	873	1,869	1,361	537	33	4,948	
1986*	9	5	-	-	-	-	117	2,817	2,093	1,555	494	336	7,426	
1987*	3	-	-	-	16	-	23	2,689	1,606	1,228	1,230	403	8,229	a

a includes catch of 1031 t from month 'unknown'
* Provisional.

Table 4a: Results of multiplicative analysis of catch and effort data for roundnose grenadier in SA 2+3 using ICNAF/NAFO statistics.

MULTIPLE R..... 0.663
MULTIPLE R SQUARED..... 0.439

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	6.820E0	6.820E0	
REGRESSION	36	3.539E1	9.831E-1	4.436
TYPE 1	7	4.185E0	5.979E-1	2.698
TYPE 2	7	1.017E0	1.452E-1	0.655
TYPE 3	3	1.734E0	5.781E-1	2.609
TYPE 4	19	2.071E1	1.090E0	4.919
RESIDUALS	204	4.521E1	2.216E-1	
TOTAL	241	8.742E1		

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	20127	INTERCEPT	0.456	0.349	241
2	10				
3	31				
4	67				
1	11115	1	-0.372	0.271	5
	11116	2	-0.564	0.285	5
	11125	3	-0.202	0.159	18
	11126	4	-0.258	0.213	6
	11127	5	0.153	0.110	34
	20126	6	0.052	0.142	16
	20157	7	0.256	0.105	34
2	1	8	-0.293	0.215	6
	6	9	0.113	0.213	6
	7	10	0.006	0.143	17
	8	11	0.104	0.108	35
	9	12	-0.022	0.093	52
	11	13	0.020	0.103	48
	12	14	-0.058	0.129	21
3	21	15	-0.039	0.091	72
	22	16	0.161	0.100	54
	23	17	-0.159	0.140	21
4	68	18	-0.330	0.338	16
	69	19	-0.235	0.474	2
	70	20	0.315	0.377	10
	71	21	0.032	0.358	18
	72	22	-0.216	0.382	8
	73	23	0.325	0.397	6
	74	24	-0.029	0.374	11
	75	25	0.073	0.371	14
	76	26	-0.233	0.371	11
	77	27	-0.341	0.362	17
	78	28	-0.196	0.355	29
	79	29	-0.630	0.353	28
	80	30	-0.422	0.369	14
	81	31	-0.774	0.360	17
	82	32	-0.682	0.365	12
	83	33	-0.688	0.400	5
	84	34	-0.499	0.472	3
	85	35	-0.849	0.394	8
	86	36	-0.704	0.392	9

Table 4b: Results of multiplicative analysis of catch and effort data for roundnose grenadier in SA 2+3 using Canadian observer statistics.

MULTIPLE R..... 0.524
MULTIPLE R SQUARED..... 0.275

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.401E1	1.401E1	
REGRESSION	20	2.054E1	1.027E0	5.760
TYPE 1	3	1.665E0	5.551E-1	3.114
TYPE 2	3	1.398E0	4.660E-1	2.614
TYPE 3	5	3.650E0	7.301E-1	4.095
TYPE 4	9	1.122E1	1.247E0	6.995
RESIDUALS	304	5.419E1	1.783E-1	
TOTAL	325	8.874E1		

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	11125	INTERCEPT	-0.213	0.156	325
2	31				
3	10				
4	78				
1	11126	1	-0.071	0.127	21
	11127	2	-0.140	0.083	76
	20127	3	0.087	0.081	95
2	21	4	0.128	0.138	29
	22	5	-0.067	0.093	67
	23	6	-0.407	0.171	27
3	7	7	0.086	0.173	9
	8	8	0.135	0.079	51
	9	9	-0.129	0.069	75
	11	10	0.068	0.079	64
	12	11	-0.288	0.130	24
4	79	12	-0.003	0.321	2
	80	13	0.705	0.220	21
	81	14	-0.025	0.145	59
	82	15	0.199	0.160	28
	83	16	-0.254	0.163	29
	84	17	0.497	0.170	39
	85	18	-0.071	0.152	34
	86	19	0.074	0.147	44
	87	20	-0.063	0.150	50

Table 5a: Standardized CPUE and effort from the multiplicative analysis of catch and effort data for roundnose grenadier in SA 2+3 using ICNAF/NAFO statistics.

STANDARDS USED VARIABLE NUMBERS: 20127 10 31

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1967	0.4563	0.1219	1.659	0.563	17304	10428
1968	0.1259	0.0337	1.246	0.227	31263	25081
1969	0.2212	0.1134	1.317	0.432	12333	9362
1970	0.7718	0.0291	2.383	0.404	22864	9593
1971	0.4886	0.0210	1.803	0.261	75445	41845
1972	0.2400	0.0331	1.398	0.253	24386	17449
1973	0.7812	0.0504	2.380	0.529	17567	7380
1974	0.4271	0.0311	1.687	0.296	28146	16687
1975	0.5291	0.0293	1.870	0.318	27425	14668
1976	0.2232	0.0308	1.376	0.240	20953	15229
1977	0.1150	0.0219	1.240	0.183	15387	12407
1978	0.2608	0.0180	1.438	0.192	20699	14397
1979	-0.1733	0.0184	0.931	0.126	7782	8356
1980	0.0345	0.0232	1.144	0.174	2053	1795
1981	-0.3181	0.0217	0.804	0.118	7085	8807
1982	-0.2254	0.0260	0.881	0.141	4344	4933
1983	-0.2318	0.0521	0.864	0.195	3569	4133
1984	-0.0427	0.1017	1.018	0.317	3873	3806
1985	-0.3928	0.0376	0.741	0.143	4948	6681
1986	-0.2472	0.0346	0.858	0.159	7426	8656

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.194

Table 5b: Standardized CPUE and effort from the multiplicative analysis of catch and effort data for roundnose grenadier in SA 2+3 using Canadian observer statistics.

STANDARDS USED VARIABLE NUMBERS: 11125 31 10

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	-0.2135	0.0243	0.873	0.136	20702	23724
1979	-0.2167	0.1147	0.831	0.274	7781	9360
1980	0.4916	0.0372	1.755	0.336	2053	1170
1981	-0.2385	0.0152	0.855	0.105	7085	8287
1982	-0.0140	0.0156	1.070	0.133	4344	4060
1983	-0.4672	0.0109	0.682	0.071	3569	5236
1984	0.2833	0.0065	1.447	0.117	3873	2677
1985	-0.2847	0.0066	0.820	0.066	4948	6035
1986	-0.1391	0.0068	0.948	0.078	7439	7845
1987	-0.2769	0.0124	0.824	0.092	8025	9741

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.138

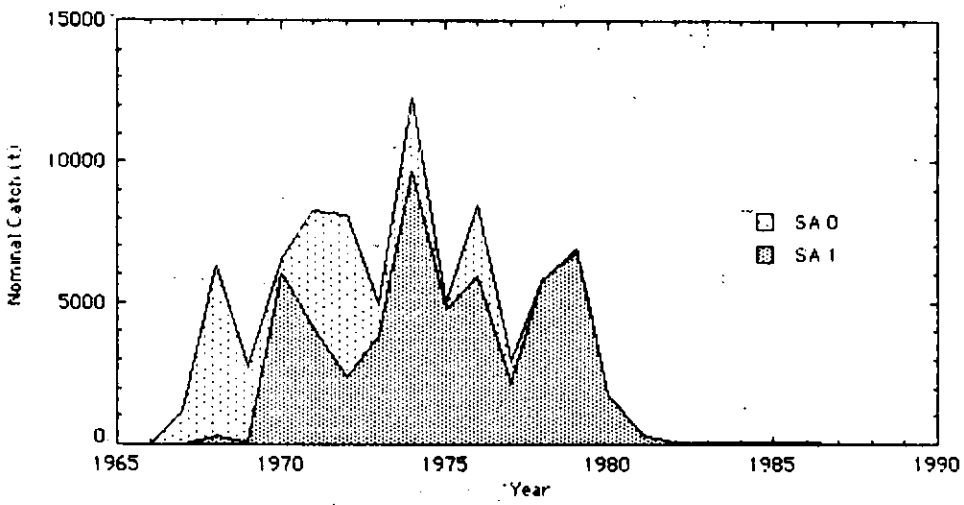

Figure 1 : Nominal catches of roundnose grenadier in SA 0+1, 1967-1987 (1986 and 1987 are provisional)

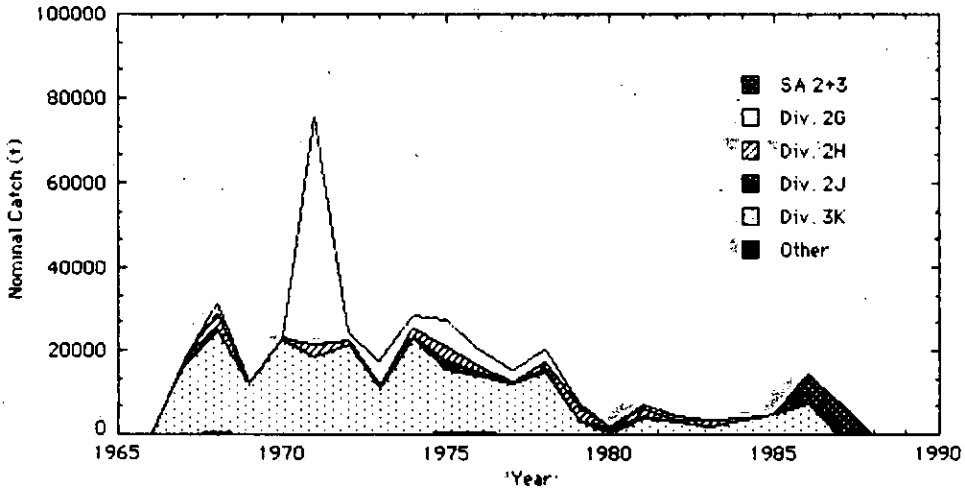

Figure 2 : Nominal catches of roundnose grenadier in SA 2+3, 1967-1987 (1986 and 1987 are provisional).

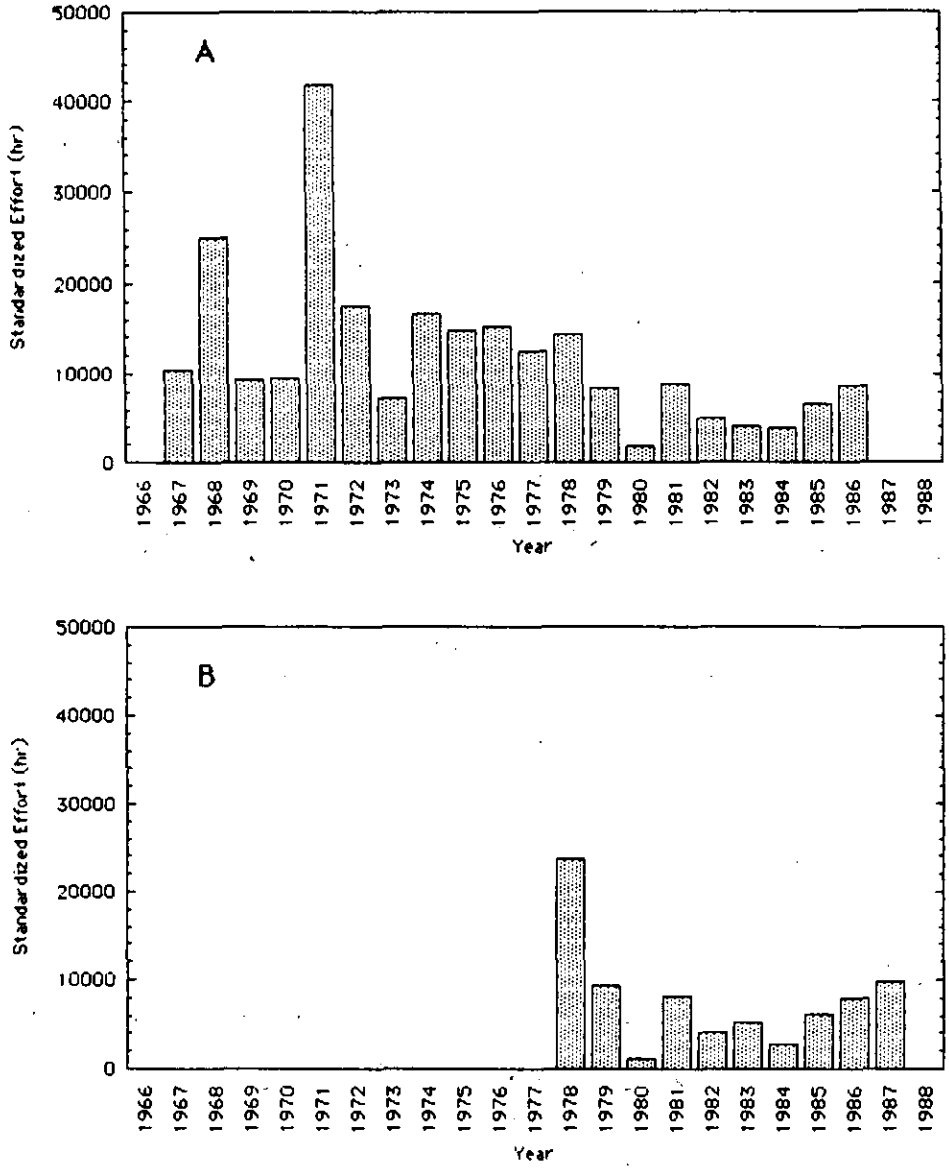

Figure 3: Standardized effort for roundnose grenadier in SA 2+3 a) derived from ICNAF/NAFO statistics, b) derived from Canadian Observer Program statistics.

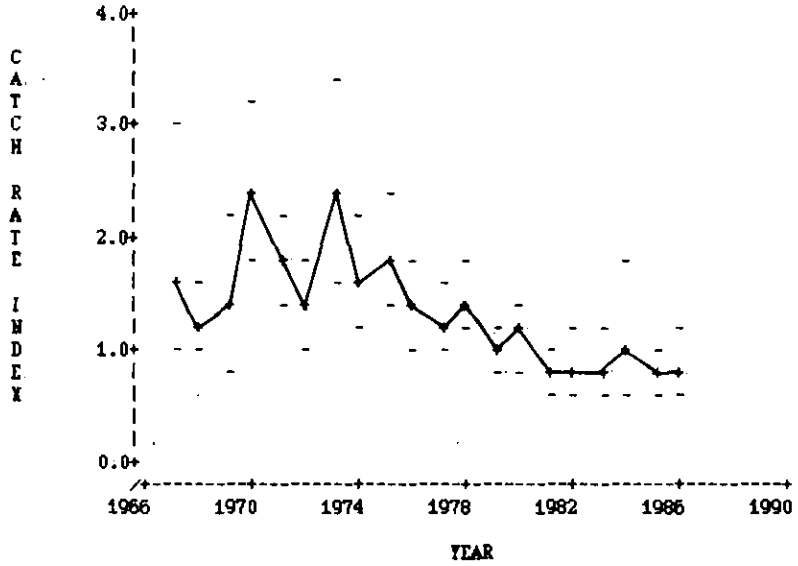

Figure 4a: Standardized catch rates (t/hr) derived from the multiplicative analysis of commercial catch and effort data (ICNAF/NAFO data) for roundnose grenadier in SA 2+3.

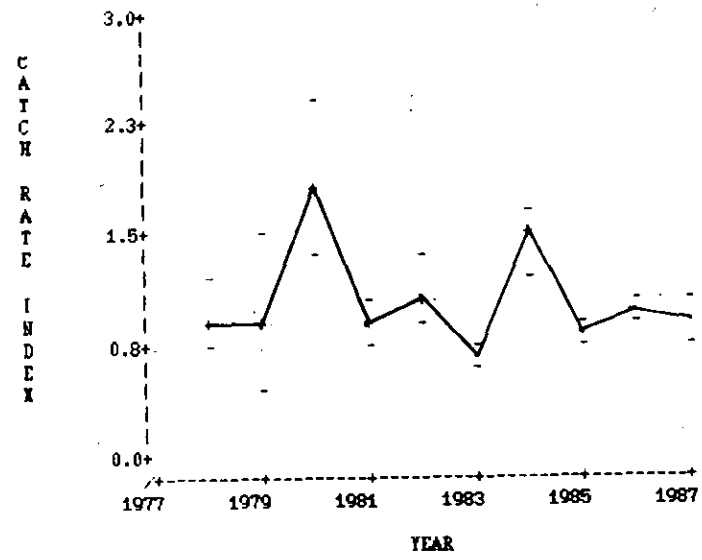

Figure 4b: Standardized catch rates (t/hr) derived from the multiplicative analysis of commercial catch and effort data (Canadian observer data) for roundnose grenadier in SA 2+3.

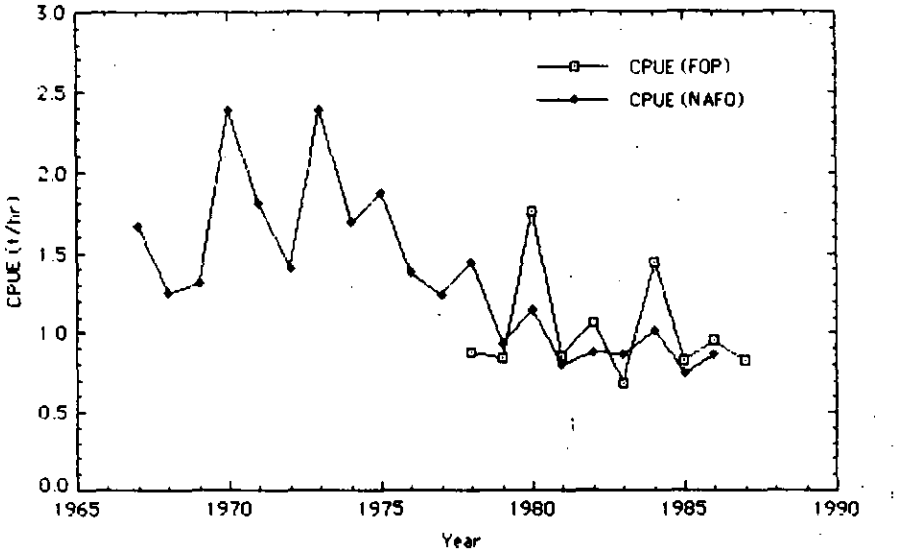

Figure 5 : Comparison of standardized catch rates derived from ICNAF/NAFO statistics , and observer data (FOP).