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Roundnose Grenadier (*Coryphaenoides rupestris*)
of NAFO Subareas 2+3 with Catch Information from Subareas 0+1

by

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Introduction

The roundnose grenadier fishery in the northwest Atlantic is relatively recent, beginning in Div. 3K in 1967, then expanding to waters off Labrador, Baffin Island and West Greenland. Prior to 1979, nominal catches of roundnose grenadier in SA 2+3 were greater than 20,000 t in most years (Table 1, Figure 2), but declined to only about 2000 t in 1980. Catches increased somewhat during the late 1980's, fluctuating around 6,000-8,000 t due to increased catches by the USSR, and to some extent, moderate increases by GDR (Table 2b). Portugal has reported catches in recent years, primarily from Div. 3L. In 1990, there were no reported catches from GDR, and the USSR landings were only about 25% of those for 1989. Conversely, catches by EEC countries increased significantly. There is some concern that a portion of the 1990 catches reported as roundnose grenadier may actually be roughheads, but it is not possible to quantify this. Previously, catches have been greatest in the second half of the year (Table 3b), but in 1990 the largest catches were taken in April, with the second and third highest monthly totals being reported in March and May. This change in season is related to the EEC fishery (Portugal) in the Div. 3LM area north of the Sackville spur.

Catches in subareas 0+1 (Tables 1, 2a and 3a; Fig. 1) indicate nothing more than a by-catch fishery since about 1979. To date there have been no reported landings for 1990.

Previous attempts to assess the roundnose grenadier stocks through use of trawl surveys have not been successful because the surveys do not cover the entire range of the distribution of these fish. Last year (Savvatimsky *et al.* 1990) various approaches to the use of analytical assessment techniques were attempted but were unsuccessful, again because of the limited distribution of the fisheries and research vessel surveys in relation to the overall distribution of the stock. It was also concluded that general production analyses were not possible because of poor relationships between catch rate and effort. There are no new data available this year which will allow us to overcome the limitations noted in the past. This paper presents an update of the catch information as well as the catch rate series.

Methods and Results

As in previous assessments, two sets of catch and effort data exist for roundnose grenadier in SA 2+3. The first is that contained in the NAFO database for the years 1967 (start of the fishery) to 1989, and the second is that compiled by Canadian observers (FOP) for 1978-1990. The NAFO database is aggregated on a monthly basis whereas the FOP data are available on a set by set basis. For both datasets, only those catches where roundnose grenadier comprised >50% of the total catch were selected. The category types of country-gear-tonnage class (CGT), NAFO division, month and year were used, similar to previous analyses. Although the FOP data were first extracted on a set by set basis, they were aggregated by trip before input into the analyses.

Both datasets were analysed using the multiplicative model (Gavaris 1980) to derive standardized catch rates. To reduce bias associated with rounding of low values of catch and effort, all catch/effort <10 units were removed from the datasets. In addition, any category types with <5 points (except years) were removed prior to analyses. The data were not weighted within the analysis.

The results using the FOP data (Table 4) indicate that the regression is significant, explaining about 42% of the variation in the data. All of the categories were significant. Examination of the residuals (Figure 3) did not reveal any problematic outliers.

The regression explained about 51% of the variation in the NAFO data (Table 6). Using these data, the month category was not significant. No outliers were detected in the residuals (Figure 4).

The catch rates from the two series (Tables 5 and 7, Figures 5, 6 and 7) suggest a gradual decline over time, particularly with the longer NAFO based series. Both indicate an increase in 1980 and 1984, most noticeably with the FOP data. The NAFO data suggest a continual decline from 1986 through 1989, while the FOP data suggest a levelling off during 1988-1990. Standardized effort (Tables 5 and 7, Figure 8) has gradually increased in recent years, related to the increases in catches, but also reflective of the continuing gradual decline in catch rates. The large discrepancy between estimated effort in 1978 from the two databases is probably a reflection of low sampling by the FOP at the time of its start up.

General production analyses were not carried out on the data as these have not been successful in the recent past, and it was felt that the addition of one more point would not suddenly give meaningful results.

Discussion

It was noted previously (Anon. 1990) that SPA is not an appropriate tool in its present form to assess roundnose grenadier in SA 2+3. Also, survey data available do not provide reasonable estimates of the stock size because all depths are not covered and the proportion of grenadier in deeper water is not known. If there is a trend in recent years for grenadier to be distributed deeper, then the decline in catch rates may reflect this movement rather than stock status, but at present this can not be evaluated.

Given the above, there are insufficient data available upon which to base an assessment. As such, the precautionary TAC of 11,000 t should remain in place for 1992 and into the future until sufficient information is available to enable an evaluation of stock status.

There is some concern that recent reported catches in the 3KLM area by EEC and Canada may, in fact, contain significant amounts of roughhead grenadiers, a species not presently under quota management. In future it is advisable that these two species be reported separately so that the apparent developing fishery may be adequately monitored. It is also important to maintain a separation of the data concerning the two species so that catch rates are representative of the appropriate species.

References

- Anon. 1990. NAFO Scientific Council Reports, 1990.
- 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.
- Savvatimsky, P.I., G.B. Rudneva, L. Danke, H. Müller, D.B. Atkinson and D. Power. MS 1990. Roundnose Grenadier (*Coryphaenoides rupestris*) in NAFO Subareas 0+1 and 2+3. NAFO SCR Doc. 89/55. Ser. No. N16135. 46p.

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	85	86	8,000	-	117	53	7,222	32	7,424	11,000
1987	-	377	377	8,000	80	254	213	6,682	1,069	8,298	11,000
1988	120	398	518	8,000	329	226	9	4,658	1,071	6,293	11,000
1989*	1	46	47	8,000	31	202	47	4,361	314	4,955	11,000
1990*			0	8,000						4,003	11,000
1991				8,000							11,000

* Provisional.

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

Country	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989*	1990*
Denmark (G)	21	-	39	37	22	25	36	81	58	138	-	-
GDR	-	-	-	-	-	-	14	-	-	-	-	-
FRG	6,794	1,721	353	11	-	-	-	-	-	-	-	-
USSR	106	32	87	43	46	25	2	1	-	120	1	-
Norway	-	-	-	-	-	-	-	-	-	-	-	-
Japan	-	-	-	-	-	-	3	4	319	260	46	-
TOTAL	6,921	1,753	479	91	68	50	55	86	377	518	47	0

* Provisional.

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

Country	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989*	1990*
Canada (M)+	-	-	-	-	-	-	-	9	10	1	19	35
Canada (N)	4	-	-	-	-	-	-	-	-	1	1	145
FRG	-	32	-	-	-	23	178	13	-	8	-	-
GDR	480	898	1,407	1,640	2,586	3,650	3,740	4,571	4,469	3,380	2,352	-
Poland	96	36	18	15	50	51	12	17	1	17	17	-
Romania	-	-	-	-	-	-	-	-	-	-	-	-
USSR	7,201	1,087	5,660	2,689	933	147	1,018	2,801	2,725	1,890	2,230	502
Japan	-	-	-	-	-	2	-	13	79	85	46	110
EEC	-	-	-	-	-	-	-	-	-	-	-	3,211
Portugal	-	-	-	-	-	-	-	3	1,001	911	290	-
Faroese	-	-	-	-	-	-	-	-	9	-	-	-
Norway	-	-	-	-	-	-	-	-	-	-	-	-
Cuba	-	-	-	-	-	-	-	-	4	-	-	-
TOTAL	7,781	2,053	7,085	4,344	3,569	3,873	4,948	7,427	8,298	6,293	4,955	4,003

* 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
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	-	-	-	-	-	-	-	48	180	-	87	4	377 d
1988	6	11	6	8	48	26	2	180	43	163	20	5	518
1989*	-	-	-	-	11	23	2	-	1	10	-	-	47
1990*	-	-	-	-	-	-	-	-	-	-	-	-	0

a includes 7 t from month 'unknown'; b includes 6 t from month 'unknown'.

c includes 1 t from month 'unknown'; d includes 58 t from month 'unknown'; * Provisional

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
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	2,818	2,093	1,555	494	336	7,427
1987	71	111	45	96	75	5	22	2,732	1,633	1,561	1,319	628	8,298
1988	415	33	38	-	8	87	841	837	690	1,485	1,608	251	6,293
1989*	76	23	25	23	39	54	579	1,497	703	902	946	88	4,955
1990*	120	312	576	1,171	512	-	185	423	90	120	76	116	4,003 a

a includes 302 t from month 'unknown'; * Provisional.

Table 4: Regression of the multiplicative model for roundnose grenadier in SA 2+3 using the FOP data, 1978-1990.

MULTIPLE R..... 0.651
 MULTIPLE R SQUARED..... 0.424

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.391E1	2.391E1	
REGRESSION	23	3.727E1	1.620E0	10.130
CGT	3	1.410E0	4.701E-1	2.939
DIVISION	3	1.399E0	4.664E-1	2.916
MONTH	5	4.260E0	8.519E-1	5.326
YEAR	17	2.366E1	1.971E0	12.323
RESIDUALS	316	5.055E1	1.600E-1	
TOTAL	340	1.117E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	20127	INTERCEPT	-0.256	0.135	340
2	31				
3	10				
4	78				
1	11125	1	-0.116	0.083	92
	11126	2	-0.102	0.079	67
	11127	3	-0.221	0.076	58
2	21	4	0.247	0.110	19
	22	5	0.120	0.089	41
	23	6	-0.175	0.151	13
3	7	7	0.354	0.127	17
	8	8	0.058	0.073	74
	9	9	-0.063	0.065	87
	11	10	0.143	0.071	62
	12	11	-0.317	0.126	13
4	79	12	0.161	0.317	2
	80	13	0.674	0.197	12
	81	14	0.277	0.144	35
	82	15	0.266	0.151	23
	83	16	-0.268	0.170	21
	84	17	0.717	0.174	22
	85	18	0.031	0.151	34
	86	19	0.181	0.144	41
	87	20	0.025	0.136	46
	88	21	-0.310	0.137	42
	89	22	-0.429	0.133	45
	90	23	-0.370	0.230	4

Table 5: Standardized CPUE and effort from the multiplicative model for roundnose grenadier in SA 2+3 using the FOP data, 1978-1990.

STANDARDS USED VARIABLE NUMBERS: 20127 31 10

PREDICTED CATCH RATE

YEAR	LN TRANSFORM		RETRANSFORMED		CATCH	EFFORT
	MEAN	S.E.	MEAN	S.E.		
1978	-0.2558	0.0182	0.831	0.112	20702	24902
1979	-0.0946	0.0969	0.939	0.286	7781	8287
1980	0.4186	0.0252	1.626	0.257	2053	1263
1981	0.0708	0.0120	1.100	0.120	7085	6443
1982	0.0104	0.0111	1.089	0.114	4344	3990
1983	-0.5239	0.0170	0.636	0.083	3569	5610
1984	0.4616	0.0151	1.706	0.209	3873	2270
1985	-0.2244	0.0107	0.861	0.089	4948	5746
1986	-0.0744	0.0082	1.002	0.091	7424	7411
1987	-0.2310	0.0085	0.856	0.079	8298	9689
1988	-0.5656	0.0099	0.612	0.061	6293	10275
1989	-0.6850	0.0081	0.544	0.049	4955	9108
1990	-0.6258	0.0455	0.566	0.120	4003	7067

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.135

Table 6: Regression of the multiplicative model for roundnose grenadier in SA 2+3 using the NAFO data, 1967-1989.

MULTIPLE R..... 0.712
 MULTIPLE R SQUARED..... 0.508

ANALYSIS OF VARIANCE

VARIATION	DF	SQUARES	SQUARES	F-VALUE
INTERCEPT	1	2.469E0	2.469E0	
REGRESSION	41	5.209E1	1.271E0	5.857
CGT	7	4.043E0	5.776E-1	2.663
MONTH	7	1.355E0	1.936E-1	0.892
DIVISION	5	2.925E0	5.849E-1	2.697
YEAR	22	3.239E1	1.472E0	6.788
RESIDUALS	233	5.054E1	2.169E-1	
TOTAL	275	1.051E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	20127	INTERCEPT	0.446	0.342	275
2	10				
3	31				
4	67				
1	11115	1	-0.349	0.268	5
	11116	2	-0.530	0.281	5
	11125	3	-0.128	0.121	31
	11126	4	-0.233	0.209	6
	11127	5	0.154	0.100	39
	20126	6	0.067	0.140	16
	20157	7	0.256	0.100	36
2	1	8	-0.318	0.212	6
	6	9	0.096	0.210	6
	7	10	0.047	0.132	20
	8	11	0.076	0.098	43
	9	12	-0.056	0.088	59
	11	13	0.041	0.094	57
	12	14	-0.104	0.124	22
3	21	15	-0.046	0.086	75
	22	16	0.096	0.090	58
	23	17	-0.195	0.132	21
	32	18	0.284	0.288	3
	33	19	1.268	0.493	1
4	68	20	-0.277	0.332	16
	69	21	-0.235	0.468	2
	70	22	0.410	0.368	11
	71	23	0.067	0.353	18
	72	24	-0.187	0.376	8
	73	25	0.333	0.392	6
	74	26	0.001	0.369	11
	75	27	0.123	0.365	14
	76	28	-0.194	0.366	11
	77	29	-0.314	0.357	17
	78	30	-0.164	0.350	29
	79	31	-0.583	0.348	28
	80	32	-0.431	0.361	15
	81	33	-0.750	0.354	17
	82	34	-0.655	0.360	12
	83	35	-0.655	0.395	5
	84	36	-0.536	0.451	3
	85	37	-0.851	0.383	8
	86	38	-0.711	0.381	9
	87	39	-0.858	0.377	10
	88	40	-0.951	0.367	12
	89	41	-1.232	0.373	10

Table 7: Standardized CPUE and effort from the multiplicative model for roundnose grenadier in SA 2+3 using the FOP data, 1978-1990.

STANDARDS USED VARIABLE NUMBERS: 20127 10 31

PREDICTED CATCH RATE

YEAR	LN TRANSFORM		RETRANSFORMED		CATCH	EFFORT
	MEAN	S.E.	MEAN	S.E.		
1967	0.4462	0.1172	1.643	0.547	17304	10535
1968	0.1690	0.0319	1.299	0.231	31263	24060
1969	0.2108	0.1107	1.302	0.422	12333	9470
1970	0.8562	0.0263	2.591	0.418	22864	8826
1971	0.5129	0.0197	1.844	0.258	75445	40916
1972	0.2594	0.0320	1.422	0.253	24386	17146
1973	0.7796	0.0484	2.373	0.517	17564	7401
1974	0.4471	0.0296	1.718	0.294	28416	16539
1975	0.5692	0.0277	1.943	0.322	27425	14115
1976	0.2520	0.0289	1.414	0.239	20593	14563
1977	0.1321	0.0207	1.259	0.181	15386	12217
1978	0.2818	0.0167	1.466	0.189	20702	14124
1979	-0.1372	0.0169	0.964	0.125	7781	8072
1980	0.0156	0.0213	1.121	0.163	2053	1832
1981	-0.3040	0.0205	0.814	0.116	7085	8701
1982	-0.2090	0.0248	0.894	0.140	4344	4861
1983	-0.2085	0.0502	0.883	0.196	3569	4043
1984	-0.0902	0.0903	0.974	0.287	3873	3977
1985	-0.4047	0.0349	0.731	0.136	4948	6769
1986	-0.2653	0.0320	0.842	0.150	7424	8821
1987	-0.4115	0.0318	0.727	0.129	8298	11410
1988	-0.5048	0.0283	0.664	0.111	6293	9483
1989	-0.7860	0.0295	0.501	0.085	4955	9897

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.186

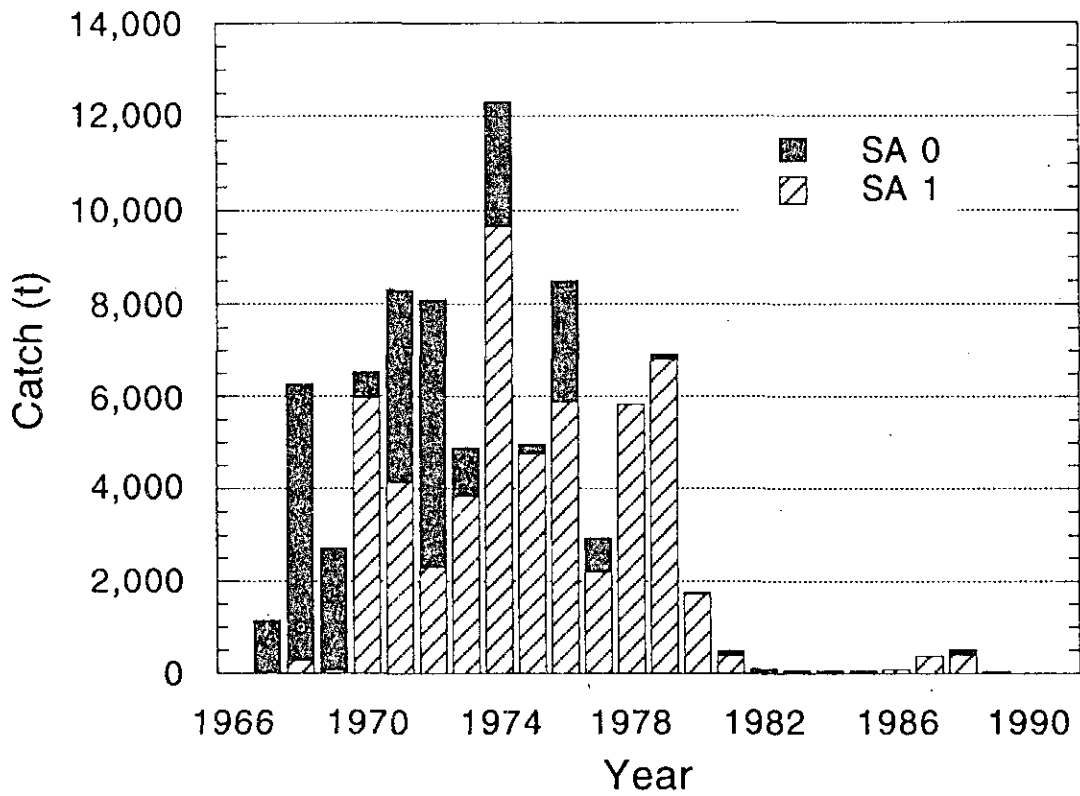


Figure 1: Nominal Catches of roundnose grenadier in SA 0+1, 1967-1990 (1989 and 1990 are provisional).

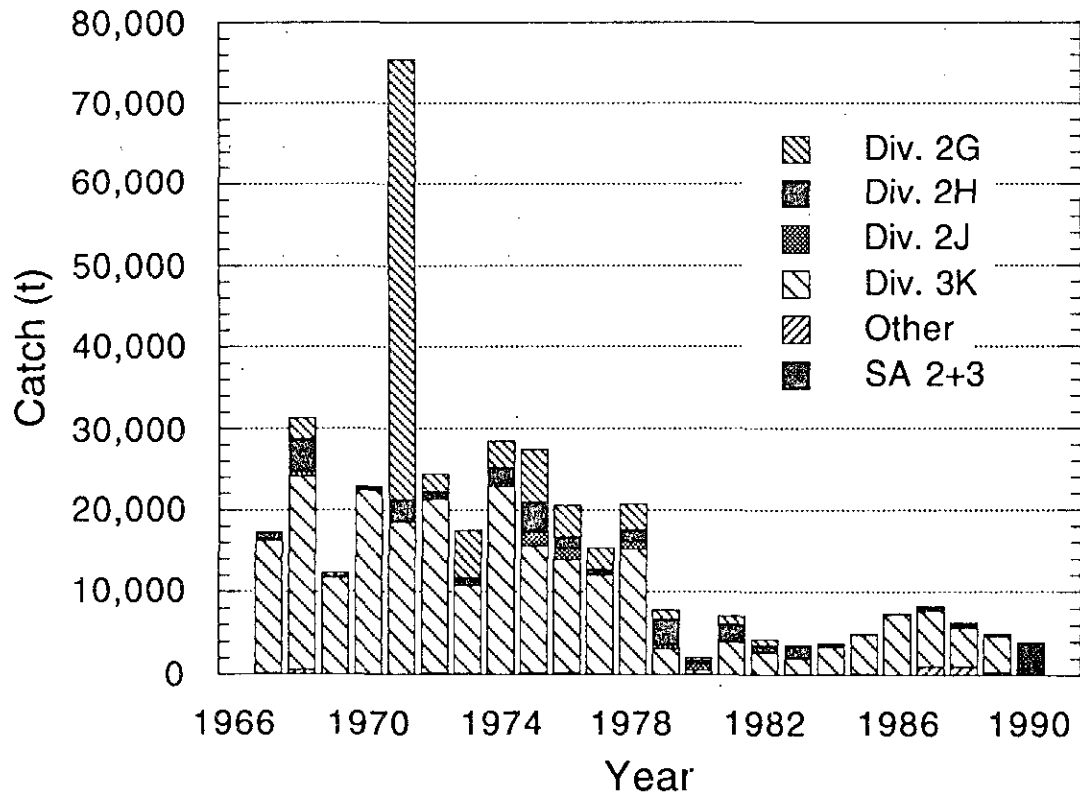


Figure 2: Nominal Catches of roundnose grenadier in SA 2+3, 1967-1990 (1989 and 1990 are provisional).

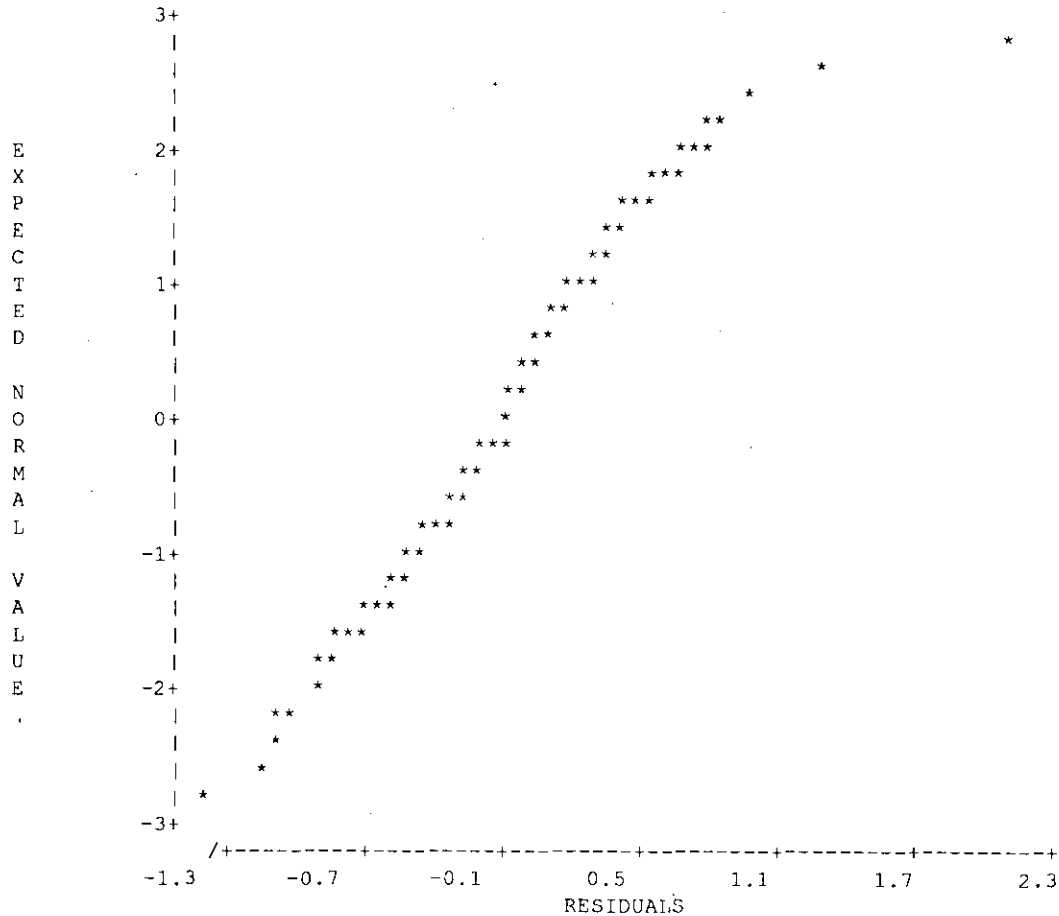
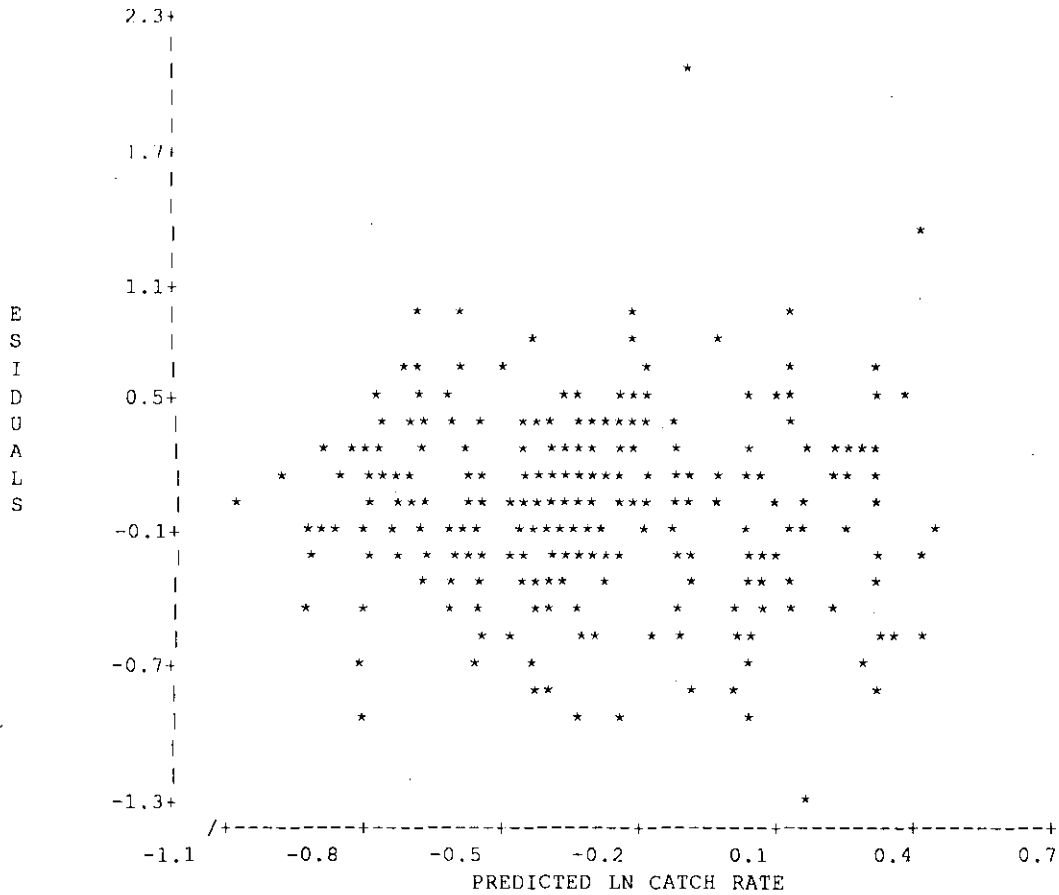


Figure 3: Residual plots from the multiplicative analysis of FOP data for roundnose grenadier in SA 2+3.

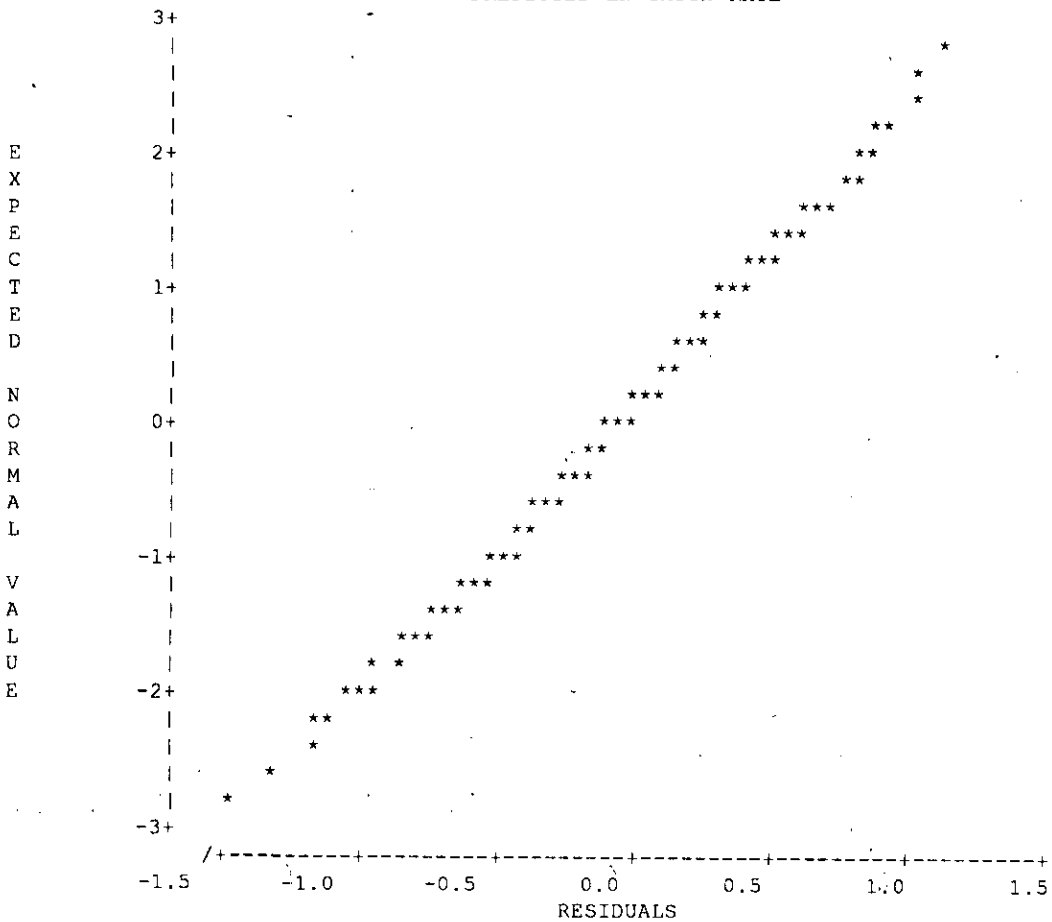
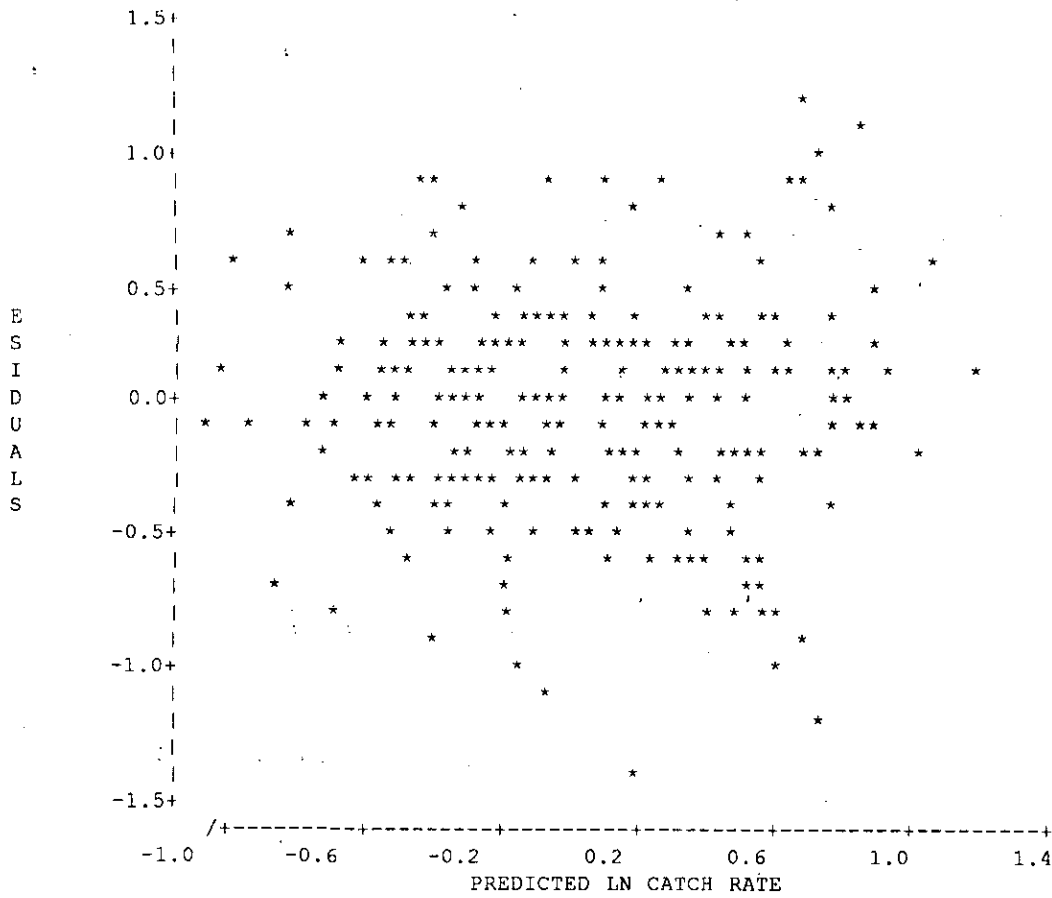


Figure 4: Residual plots from the multiplicative analysis of NAFO data for roundnose grenadier in SA 2+3.

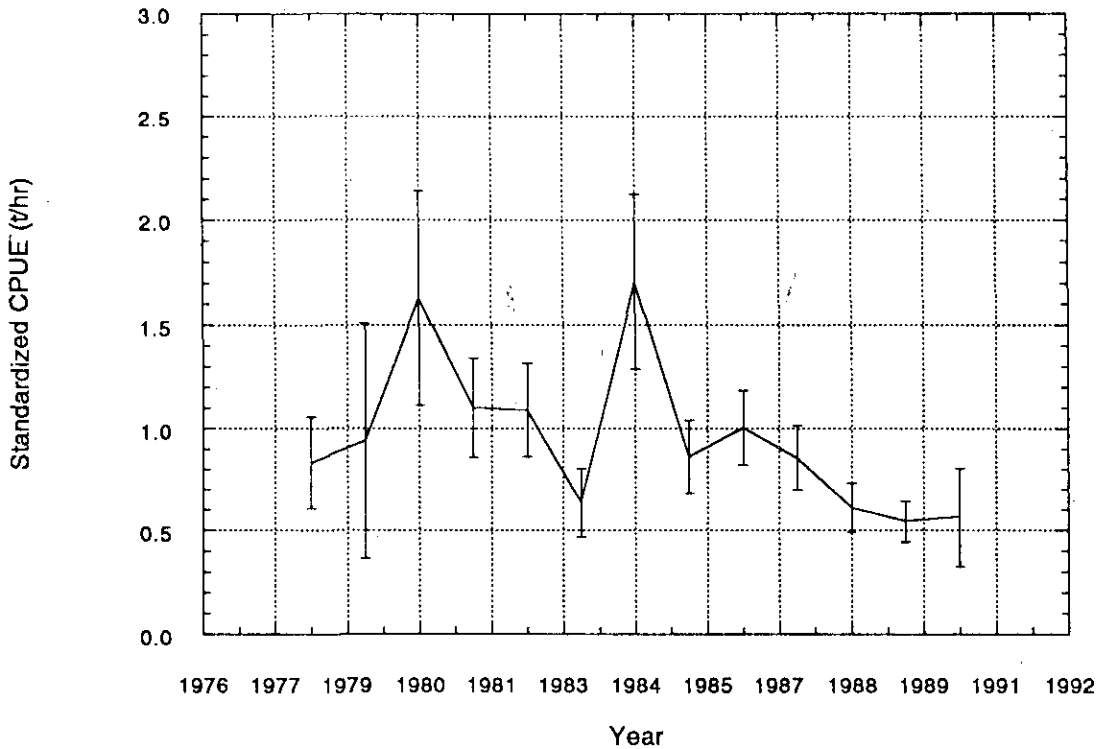


Figure 5: Standardized catch rates (t/hr) for roundnose grenadier in SA 2+3 from the multiplicative model using FOP data.

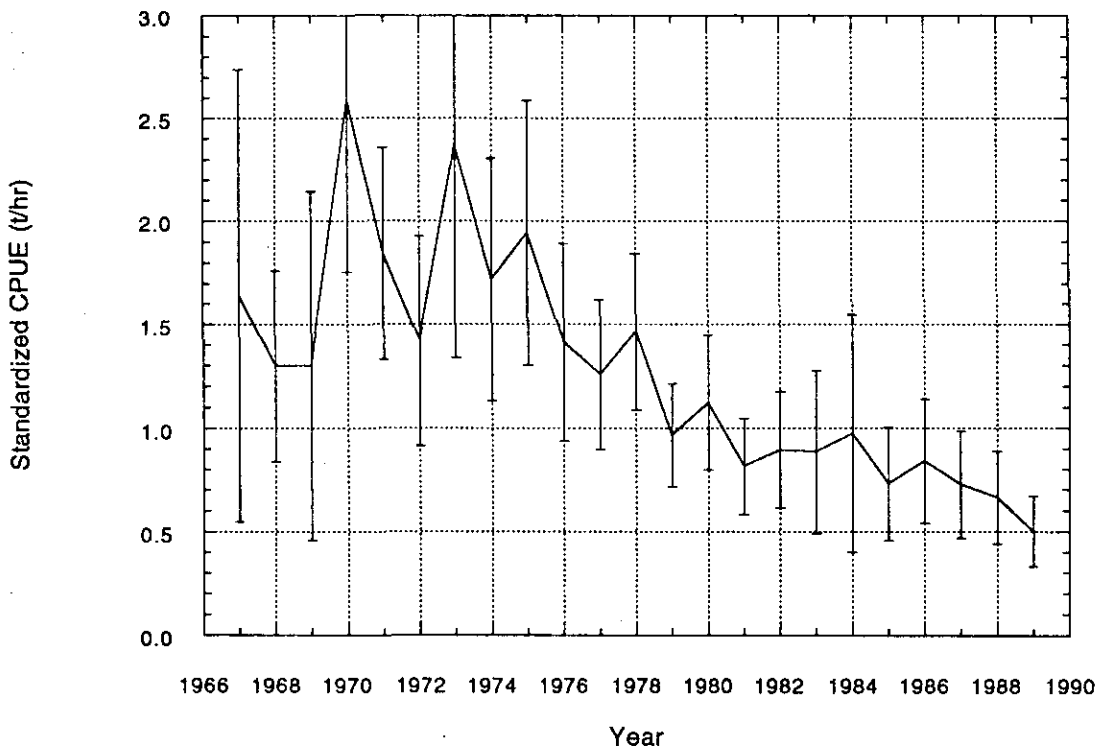


Figure 6: Standardized catch rates (t/hr) for roundnose grenadier in SA 2+3 from the multiplicative model using NAFO data.

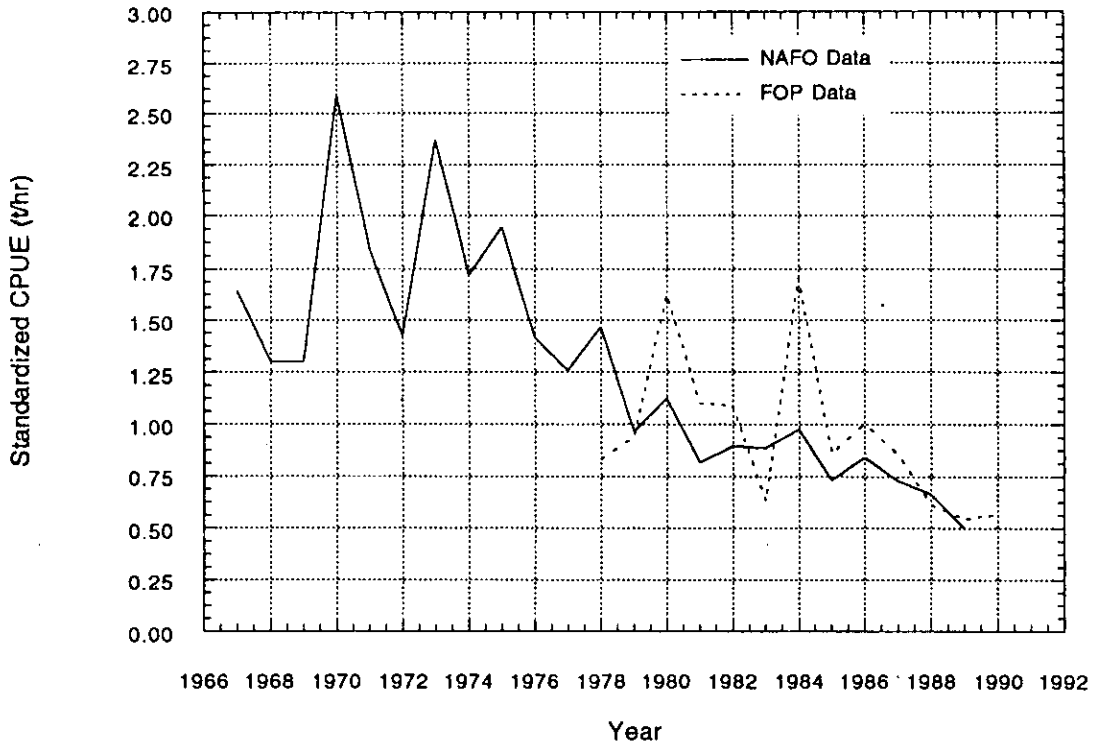


Figure 7: Standardized CPUE (t/hr) for roundnose grenadier in SA 2+3 from the multiplicative model using FOP and NAFO data.

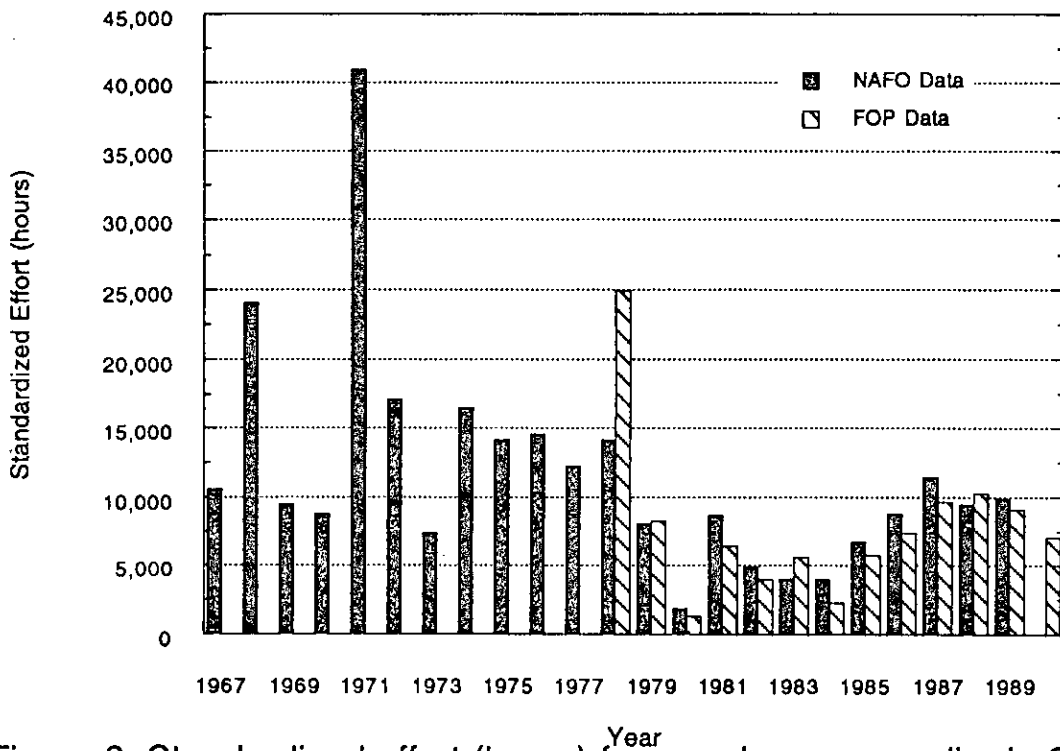


Figure 8: Standardized effort (hours) for roundnose grenadier in SA 2+3 from the multiplicative model using FOP and NAFO data.