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Status of Roundnose Grenadier Stocks in Subareas 0+1 and 2+3

by

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INTRODUCTION

With the exception of analyses by Borrmann (1976, 1978), analytical assessment techniques have not been used for these stocks. Up until the 1981 assessments the general production model was used but in that year it was noted that the catch in 0+1 was only a by-catch and for the 2+3 stock incorporation of the 1979 data resulted in a regression of catch rate on effort that was not statistically significant. The catch rate series for this stock was discussed and USSR scientists indicated that the recent low catches were a result of by-catch restrictions and were not indicative of stock trends. The suggested TAC's for these stocks for 1982 were the same as those for 1981 as no additional information was available for the 0+1 stock and since the average catch from 1967 to 1978 in 2+3 was 26,000 t close to the 1981 TAC of 27,000 t.

METHODS AND RESULTS

Nominal catches for the two stocks are shown in Table 1 (broken down by Subarea and Division) and for the 2+3 stock in Fig. 1. Catches in 0+1 have fluctuated since 1967, peaking at 12,300 t in 1974 and reaching a provisional low of 400 t in 1981. The majority of the catches were originally taken in SA0 but shifted to SA1 since about 1974. This occurred in relation to a shift from a USSR fishery to an EEC fishery. Since the imposition of TAC's (1975) they have not been achieved.

Except for 1971, catches in 2G have averaged about 3000 t. In 2H, 2J, and 3K catches have averaged about 2,000 t, 600 t, and 15,000 t with other areas (3L, 3M, 3N) averaging 150 t. The decreased catches in recent years are largely reflected by decreases in 3K.

Again in 1980 the majority of the catch in 0+1 was by-catch, provisional statistics suggesting that only about 15% of the catch was taken in a directed fishery. Because of this, no further analyses were carried out for this stock.

The multiplicative model (Gavaris 1980) was again used to standardize the catch rates for grenadier in 2+3. In addition to NAFO statistics being available through 1980, data were available from the Foreign Observer Program (F.O.P.) so that two sets of analyses were carried out: 1) using NAFO data only and 2) combining the NAFO and F.O.P. data. For both, the regression of ln (catch rate) versus vessel type, month, and year categories, weighted by effort was used to obtain estimates relative to 1967 which was set at 1. For both runs USSR OTB27, OTM27, OTB26, GDR OTB27, OTB25, 2GHJ, 3KL, and the months January, June-December were used. For the run with NAFO data only, May-June and 3K-3L were combined as they showed no significant differences while 2G-3L, August-September and October-November were combined when using NAFO and F.O.P. data. The standardization procedures (Tables 2-3) show significance with the assumptions of the model being met. The relative powers and effort do not differ greatly between the two techniques (Tables 2-Fig. 2). Only the catch rates using NAFO and F.O.P. data are plotted and these include an estimate for 1981 (Fig. 3). It can be seen that there has been a steady decline in catch rates since 1970.

Regressions of relative CPUE versus effort were carried out first including the 1971 point then excluding it. The results (Tables 4-5, Fig. 4-5) indicate that none are significant and, thus, once again the general production model cannot be used. The regressions are only significant if the 1971 and the 1979-81 points are omitted (i.e. the 1980 assessment).

DISCUSSION

That the catch rate versus effort regressions are not significant may indicate that the stock is not in equilibrium or that the catch/effort data are suspect or both. It is certain that there are problems with the catch/effort data, particularly in the manner of reporting in that this fishery is frequently grouped with others under GRO or MIX. Incorporation of the F.O.P. data, however, does not cause any reversal of trend and the 1981 point, using F.O.P. data only, is the lowest on record. It has been pointed out that the low catches in recent years are due to by-catch restrictions. With the increase in the stock size of Greenland halibut and the resultant possible increases in overlap of concentrations of the two species, it may be that vessels fishing for roundnose grenadier are forced to fish marginal areas where catch rates are lower regardless of stock status. If this is the case, then a decrease in catch rates may not be indicative of the status of this stock. Sufficient data are not available at present to resolve these questions. Since 1976 catches have not exceeded 21,000 t, averaging only 13,300 t. Since 1979 the average catch has been only 5500 t.

In light of the above, it is extremely important to resolve the questions relating to the catch/effort series as recent trends in both catches and catch rates would tend to suggest that this stock has been seriously depleted and drastic measures are required to remedy the situation.

REFERENCES

Borrmann, H. 1976. Roundnose grenadier stocks in ICNAF Subareas 0+1 and 2+3. ICNAF Res. Doc. 76/VI/57, Ser. No. 5397.

1978. Stock assessment of roundnose grenadier in the Northwest Atlantic. ICNAF Res. Doc. 78/VI/54, Ser. No. 5220.

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.

Table 1. Roundnose grenadier nominal catches by Subarea and Division 0+1, 2+3.

Year	Subarea/Division 0	1	Total 0+1	2G	2H	2J	3K	Other	Total 2+3
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
1972	5,783	2,311	8,094	2,161	655	293	21,122	155	24,386
1973	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
1975	204	4,749	4,953	6,489	3,536	1,754	15,388	258	27,425
1976	2,610	5,893	8,503	3,841	1,460	1,381	13,636	275	20,593
1977	721	2,214	2,935	2,597	525	206	11,935	123	15,387
1978	-	5,839	5,839	3,112	1,412	913	15,250	12	20,699
1979	106	6,815	6,921	1,035	3,090	438	3,200	19	7,782
1980	32	1,752	1,784	279	493	726	451	104	2,053
1981[a]			383						6,825

[a]Provisional.

Table 2. Catch rate standardization for roundnose grenadier in 2+3 showing results of multiplicative model and resultant relative catch rates and effort using NAFO data only.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R.....0.734
MULTIPLE R SQUARED.....0.538

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.913E1	2.913E1	
REGRESSION	26	1.528E1	5.876E-1	6.944
TYPE 1	4	3.509E0	8.772E-1	10.367
TYPE 2	6	2.367E0	3.945E-1	4.663
TYPE 3	3	1.080E0	3.599E-1	4.254
TYPE 4	13	1.076E1	8.277E-1	9.782
RESIDUALS	155	1.312E1	8.462E-2	
TOTAL	182	5.752E1		

PREDICTED RELATIVE POWER

YEAR	TOTAL CATCH	PROP.	RELATIVE POWER MEAN	S.E.	EFFORT
1967	17304	0.890	1.000	0.000	17304
1968	31263	0.070	0.621	0.134	50338
1969	12333	0.551	0.668	0.086	18475
1970	22864	0.956	1.284	0.156	17809
1971	75445	0.932	1.206	0.134	62549
1972	24386	0.752	0.884	0.120	27589
1973	17564	0.489	1.218	0.204	14423
1974	28416	0.418	0.752	0.090	37799
1975	27425	0.311	0.858	0.139	31979
1976	20593	0.456	0.984	0.139	20930
1977	15386	0.812	0.598	0.077	25713
1978	20699	0.721	0.753	0.093	27492
1979	7782	0.793	0.496	0.071	15680
1980	2053	0.875	0.638	0.150	3218

AVERAGE C.V. FOR THE MEAN:0.138

Table 3. Catch rate stnadardization for roundnose grenadier in 2+3 showing results of multiplicative model and resultant relative catch rates and effort using NAFO and F.O.P. data.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R.....0.756
MULTIPLE R SQUARED.....0.572

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.845E1	2.845E1	
REGRESSION	26	1.902E1	7.317E-1	8.729
TYPE 1	4	3.773E0	9.433E-1	11.254
TYPE 2	5	2.623E0	5.247E-1	6.259
TYPE 3	3	1.211E0	4.038E-1	4.817
TYPE 4	14	1.169E1	8.351E-1	9.963
RESIDUALS	170	1.425E1	8.382E-2	
TOTAL	197	6.172E1		

PREDICTED RELATIVE POWER

YEAR	TOTAL CATCH	PROP.	RELATIVE POWER MEAN	S.E.	EFFORT
1967	17304	0.890	1.000	0.000	17304
1968	31263	0.070	0.626	0.129	49912
1969	12333	0.551	0.668	0.084	18465
1970	22864	0.956	1.284	0.151	17804
1971	75445	0.932	1.207	0.129	62499
1972	24386	0.752	0.878	0.115	27761
1973	17564	0.489	1.218	0.197	14419
1974	28416	0.418	0.755	0.087	37634
1975	27425	0.311	0.862	0.135	31833
1976	20593	0.456	0.983	0.134	20953
1977	15386	0.812	0.601	0.075	25592
1978	20699	0.721	0.751	0.090	27570
1979	7782	0.792	0.493	0.068	15775
1980	2053	0.890	0.680	0.151	3019
1981	6825	0.374	0.422	0.070	16174

AVERAGE C.V. FOR THE MEAN:0.135

Table 4. Regressions of CPUE on effort for roundnose grenadier in 2+3 using NAFO data only - A. including 1971, B. excluding 1971.

A.

CORRELATION MATRIX (WITH T-VALUES)

1.00000	0.12507
0.43667	1.00000

MEAN OF DEPENDENT VARIABLE 0.85429

VARIABLE	MEAN	ESTIMATED COEFFICIENT	STD. ERROR	T-VALUE
CONSTANT TERM		0.79990	0.14274	5.60396
1	26521.28571	0.00000	0.00000	0.43667

SOURCE OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	F-STATISTIC
MEAN	1	10.21726		
REGRESSOR;X 1	1	0.01299	0.01299	0.19068
RESIDUAL	12	0.81729	0.06811	
TOTAL	14	11.04753		

COEFFICIENT OF DETERMINATION (R*2).....	0.0156417283
CORRECTED R*2 (R*2).....	-0.0663881277
F-STATISTIC FOR SIGNIFICANCE OF REGRESSION(1, 12)	0.1906833565
STANDARD ERROR OF THE ESTIMATE.....	0.2609741194
DURBIN-WATSON STATISTIC.....	1.6849422507
COEFFICIENT OF VARIATION (AT THE MEAN OF Y)..(%)	30.5488099668

B.

CORRELATION MATRIX (WITH T-VALUES)

1.00000	-0.21300
-0.72303	1.00000

MEAN OF DEPENDENT VARIABLE 0.82723

VARIABLE	MEAN	ESTIMATED COEFFICIENT	STD. ERROR	T-VALUE
CONSTANT TERM		0.92994	0.15759	5.90120
1	23749.92308	0.00000	0.00001	-0.72303

SOURCE OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	F-STATISTIC
MEAN	1	8.89604		
REGRESSOR;X 1	1	0.03162	0.03162	0.52278
RESIDUAL	11	0.66543	0.06049	
TOTAL	13	9.59310		

COEFFICIENT OF DETERMINATION (R*2).....	0.0453692175
CORRECTED R*2 (R*2).....	-0.0414153991
F-STATISTIC FOR SIGNIFICANCE OF REGRESSION(1, 11)	0.5227794888
STANDARD ERROR OF THE ESTIMATE.....	0.2459551544
DURBIN-WATSON STATISTIC.....	1.5824977728
COEFFICIENT OF VARIATION (AT THE MEAN OF Y)..(%)	29.7323508198

Table 5. Regressions of CPUE on effort for roundnose grenadier in 2+3 using NAFO and F.O.P. data - A. including 1971, B. excluding 1971.

A.

CORRELATION MATRIX (WITH T-VALUES)

1.00000	0.17695
0.64822	1.00000

MEAN OF DEPENDENT VARIABLE 0.82853

VARIABLE	MEAN	ESTIMATED COEFFICIENT	STD. ERROR	T-VALUE
CONSTANT TERM		0.74791	0.14277	5.23867
1	25780.93333	0.00000	0.00000	0.64822

SOURCE OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	F-STATISTIC
MEAN	1	10.29701		
REGRESSOR;X 1	1	0.03097	0.03097	0.42019
RESIDUAL	13	0.95813	0.07370	
TOTAL	15	11.28611		

COEFFICIENT OF DETERMINATION (R*2).....	0.0313102083
CORRECTED R*2 (R*2).....	-0.0432043910
F-STATISTIC FOR SIGNIFICANCE OF REGRESSION(1, 13)	0.4201889108
STANDARD ERROR OF THE ESTIMATE.....	0.2714809814
DURBIN-WATSON STATISTIC.....	1.6321756282
COEFFICIENT OF VARIATION (AT THE MEAN OF Y)..(%)	32.7664525358

B.

CORRELATION MATRIX (WITH T-VALUES)

1.00000	-0.13144
-0.45929	1.00000

MEAN OF DEPENDENT VARIABLE 0.80150

VARIABLE	MEAN	ESTIMATED COEFFICIENT	STD. ERROR	T-VALUE
CONSTANT TERM		0.86855	0.16186	5.36610
1	23158.21429	0.00000	0.00001	-0.45929

SOURCE OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	F-STATISTIC
MEAN	1	8.99363		
REGRESSOR;X 1	1	0.01444	0.01444	0.21095
RESIDUAL	12	0.82119	0.06843	
TOTAL	14	9.82926		

COEFFICIENT OF DETERMINATION (R*2).....	0.0172755237
CORRECTED R*2 (R*2).....	-0.0646181827
F-STATISTIC FOR SIGNIFICANCE OF REGRESSION(1, 12)	0.2109505655
STANDARD ERROR OF THE ESTIMATE.....	0.2615960040
DURBIN-WATSON STATISTIC.....	1.4368029240
COEFFICIENT OF VARIATION (AT THE MEAN OF Y)..(%)	32.6383036844

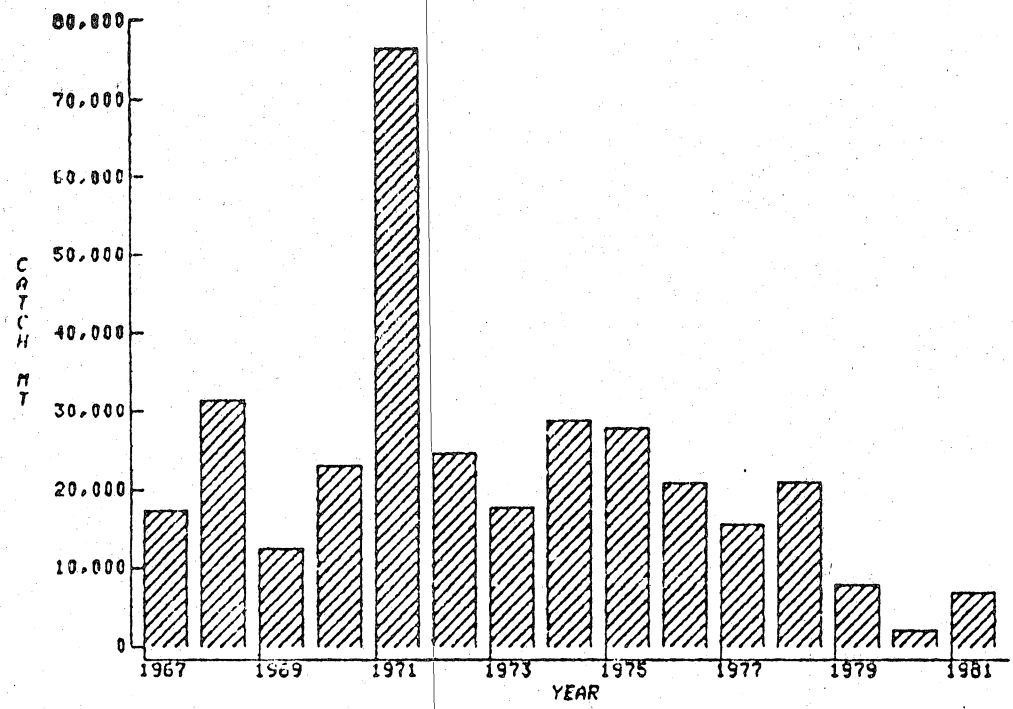

FIG.1:NOMINAL LANDINGS OF ROUNDNOSE GRENADIER FROM 2+3.

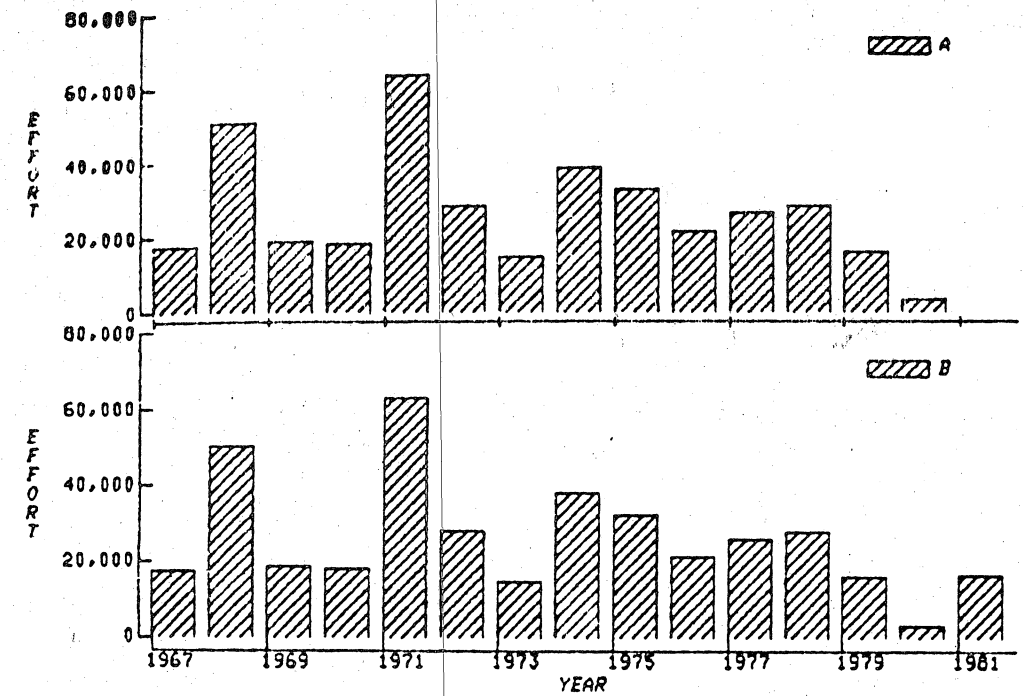

FIG.2:STANDARDIZED EFFORT ROUNDNOSE GRENADIER 2+3. A) NAFO DATA. B) NAFO + FOP DATA

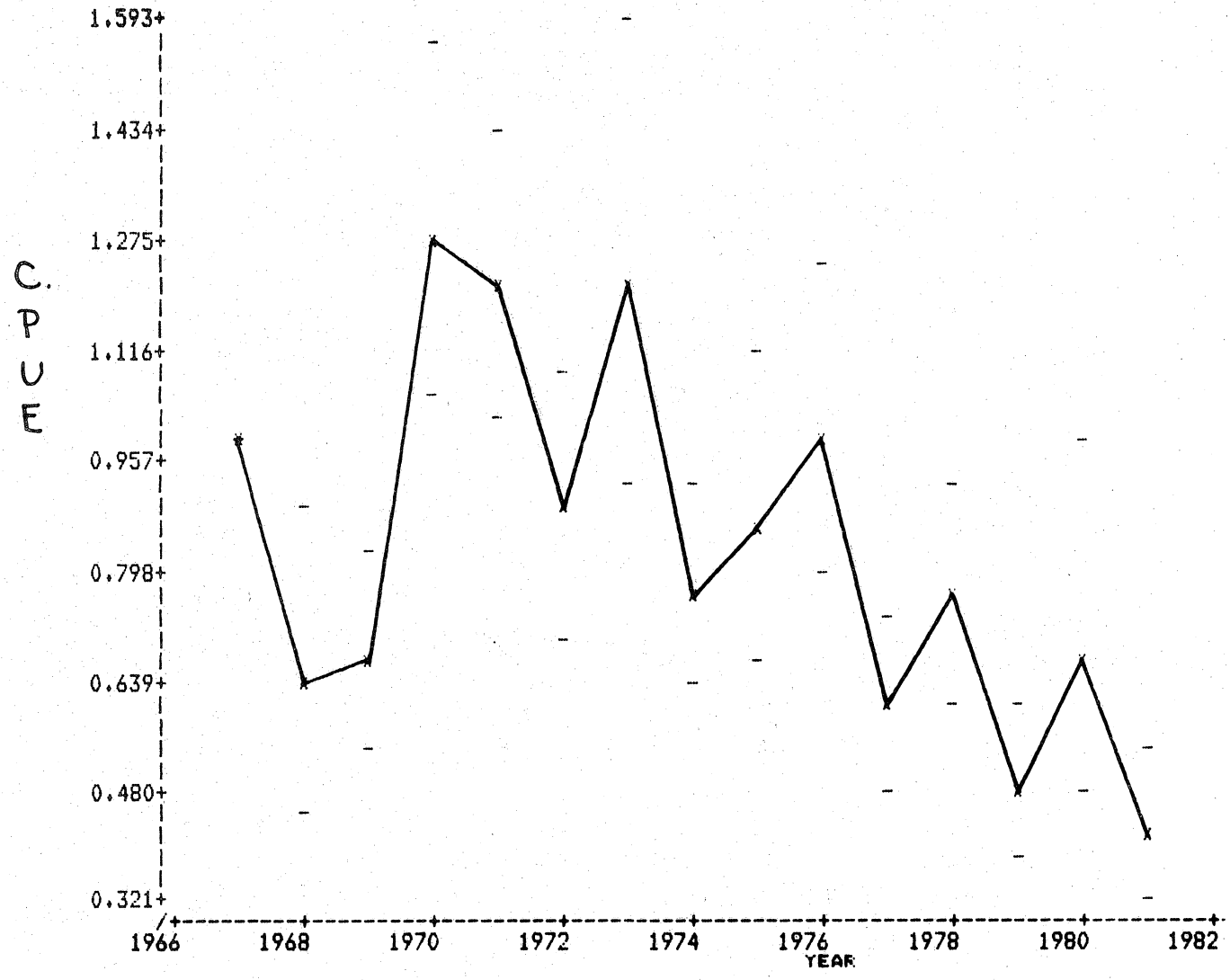

Fig. 3. Standardized catch rates for roundnose grenadier in 2+3 using NAFO and F.O.P. data.

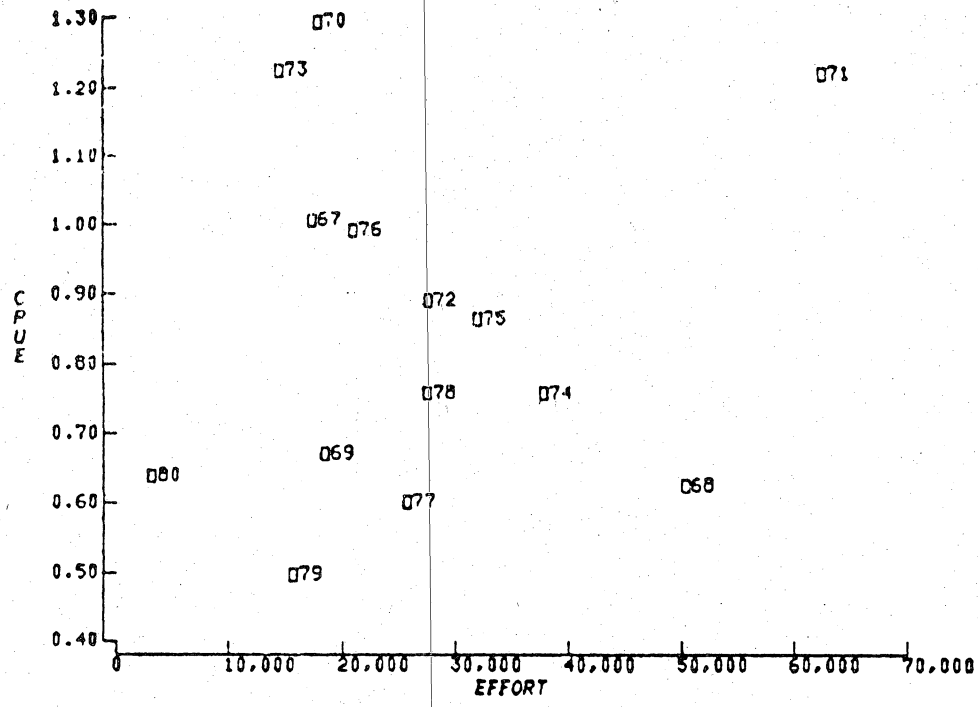

FIG.4:C.P.U.E. VS EFFORT FOR ROUNDNOSE GRENADIER IN 2+3 USING NAFO DATA.

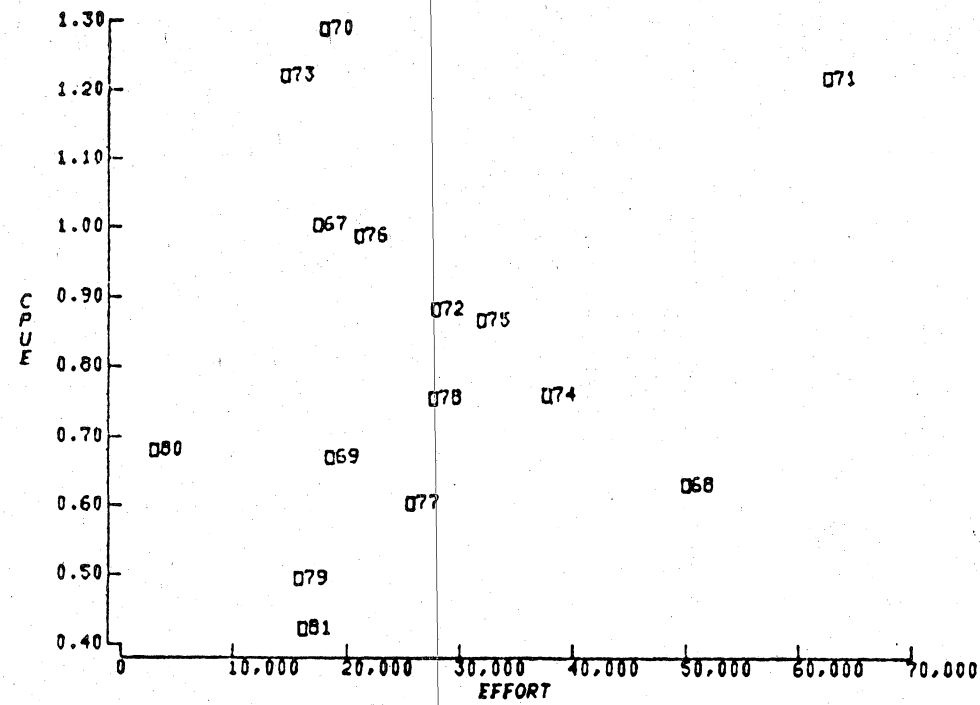

FIG.5:C.P.U.E. VS EFFORT FOR ROUNDNOSE GRENADIER IN 2+3 USING NAFO AND FOP DATA.