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International Commission for the Northwest Atlantic Fisheries

Serial No. 3807
(D.c.3)

ICNAF Res.Doc. 76/VI/27
Corrigendum

ANNUAL MEETING - JUNE 1976

Preliminary stock assessments of roundnose grenadier in ICNAF Subareas 0 + 1 and 2 + 3

by

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German Democratic Republic

Corrections:

Page 5, line 33: for M = 0.1, read M = 0.2.

Page 11, Fig. 2: for t_o = 0.034, read t_o = 3.034.

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Abstract

Stock sizes and fishing mortalities of roundnose grenadier in SA 2/3 and SA 0/1 were calculated by using cohort analysises dealing with age compositions and length compositions, respectively. Further Y/R curves and sustainable yiedlds were estimated. Two options of M were used (M = 0.1 and 0.2). Biological input data are only used from G.D.R. sampling.

It can be seen from the results that the fishing mortalities and catches of the last years are in the range of the calculated $F_{0.1}$ and sustainable yields at $F_{0.1}$

Material and Methods

All calculations are based on biological data sampled by G.D.R. in the 4th quarter of the year. Sampling and data preparation were done by H. KOCH and P. ERNST. For the assessments for ICNAF Subareas 2/3 biological data were only available from ICNAF Subarea 2. Moreover for the two management units (SA 2/3 and SA 0/1) representative biological data were not available for all years. Therefore we had to take for the analysis data from different years.

Cohort analysises dealing with length composition data (JONES, 1974) and with age composition data (POPE, 1972) were made. Cohort analysises dealing with length composition data were made, because age composition data based on the latest age reading technic (KOCH, 1976; SAVVATIMSKY, KOCH, ERNST, 1976) are ready only for the years 1973 and 1974 until now. Because recruits and mean age of recruitment (t φ ') were needed for the calculations of sustainable yields, cohort analysises dealing with age compositions were made with some assumptions.

Yield calculations were made using the Beverton and Holt yield equation solved by incomplete Beta function.

Input data for cohort analysis dealing with length compositions:

Length composition of total catch was calculated for the years 1969, 1970, 1971, 1973 and 1974 for SA 2/3 and for 1969, 1970, 1973 and 1974 for SA 0/1. Used length compositions can be seen in Table 5. The mean of these compositions summed up in 6 cm-groups was used for the cohort analysis (Table: 1,3).

Mean weights per length group were used from the length weight relation shown in Fig. 1 .

M = 0.1 and 0.2 and final F = 0.1 (estimated by a first run) were used. Growth parameters were calculated from mean length per age group. The parameters for SA 2/3 are:

L_∞ = 87.4290, K = 0.0908, t_0 =-0.1646 (ICNAF Subdivision 2 H, 1974)

for SA 0/1:

L_∞ = 80.6507, K = 0.119, t_0 = 3.0340 (ICNAF Subdivision 1 C, 1973).

(see also Fig. 2)

Input data for cohort analysis dealing with age compositions:

The mean age composition of 1973 and 1974 was used to distribute the mean total number in the catches used for the cohort analysis dealing with length compositon. Used age compositions can be seen in Table 6. It was assumed that this age composition corresponds to the age composition of a medium sized yearclass and that the strength of the yearclasses varies only to a small extent, which could be concluded from length compositions used for cohort analysis dealing with the length compositons. For M and final F the same values as for cohortanalysis dealing with lèngth composition were used: M = 0.1 and 0.2, final F = 0.1.

Input data for the calculation of Y/R curves and the sustainable yields:

Calculations of Y/R were made for M = 0.1 and M = 0.2.
K and t_0 were used from the growth curves for length (see above).
W_∞ were calculated with L_∞ and the length weight relations for Subarea 2 and 3:

$W = 0.0094 \cdot L^{2.6583}$ (Subdivision: 2 H, 1971),
$W_\infty = 1364$

for Subarea 1 and 0:

$W = 0.0441 \cdot L^{2.3154}$ (Subarea: 1 and 0, 1974)
$W_\infty = 1145$

(see also Fig. 1)

The mean age of recruitment (t_ρ') was calculated by the expression

$$\bar{t}_\rho{}' = \frac{\sum_{y=1}^{z} t_y \cdot \Delta F_y}{\sum_{y=1}^{z} \Delta F_y}$$ (BEVERTON and HOLT, 1957)

and the F values from cohort analysis dealing with age composition. The full recruited age group was about 15 and t_ρ' about 13 in both areas.

$t_\rho = 3$ and $t_\lambda = 22$ were used because the age compositions comprise this range.

δ was used from the length-weight relations shown above.
All input data can also be seen in Fig. 3.

The sustainable yields were calculated by multiplying the number of fish in the stock at age group 3 (results of the cohort analysis dealing with age compositions) by the Y/R at $F_{0.1}$ and F_{max}, respectively, of the corresponding yield curves.

Results

Subarea 2/3:

The results of the cohort analysis are shown in Table 1 and 2. The calculated stock size are 1620 millions (using length compositions) and 1433 millions (using age compositions) for M = 0.1, and 6957 millions and 3811 millions, respectively for M = 0.2.

The mean F-values for the total stocks are 0.016 and 0.044, respectively using M = o.1, and 0.004 and 0.017, respectively using M = 0.2. Fishing mortalities for the full rectuited stock are 0.334 using M = o.1 and 0.242 using M = 0.2.

The results of the yield estimations can be seen in the following Table:

	$F_{0.1}$	Y/R (kg)	Y (1000 tons)	F_{max}	Y/R (kg)	Y (1000 tons)
M= 0.1	0.2	0.168	31.8	>2.0	0.192(F=2)	36.4
M= 0.2	0.4	0.055	40.8	>2.0	0.067(F=2)	49.7

Y/R curves are plotted in Fig. 3.

Subarea 0/1:

The results of the cohort analysis are shown in Table 3 and 4. The calculated stock sizes are 211 millions (using length compositions) and 243 millions (using age compositions) for M =0.1, and 578 millions and 918 millions, respectively for M = 0.2.

The mean F-values for the total stock are 0.034 and 0.044, respectively using M = 0.1, and 0.014 and 0.016, respectively using M = 0.2. Fishing mortalities for the full recruited stock are 0.316 using M = 0.1 and 0.221 using M = 0.2.

The results of the yield estimations can be seen in the following Table:

	$F_{0.1}$	Y/R (kg)	Y (1000 tons)	F_{max}	Y/R (kg)	Y (1000 tons)
M = 0.1	0.3	0.164	7.4	1.6	0.182	8.3
M = 0.2	0.5	0.055	9.8	>2.0	0.064(F=2)	11.4

Y/R curves are plotted in Fig. 3.

Discussion

The calculated stock sizes using the two cohort analysis were in some cases very different. This may be caused by the sensitivity of the cohort analysis dealing with length compositons to the parameters K and L_∞. The sensitivity to L_∞ can be seen in the result of the first calculation for M = 0.2 for SA 2/3 where we started our calculation at length group 84 and got a stock size of 13134 millions. The reason for the great difference was the small difference between L_∞ and the final length group that caused a too large stock size at the final length group.

Therefore we started our final calculations for M = 0.2 with length group 78 to which we also added the catches of longer fish. Then we got the stock size of 6957 millions.

The mean F values for the total stocks resulting from the two cohort analysises are not so different, especially for SA 0/1. This may give us an indication that the age compositions and length compositions are in a good correspondence. It can also be seen that the F values are nearly the same for SA 2/3 and 0/1, expecially in the results of cohort analysis dealing with age compositions. This is also true for the mean F values for the full recruited stock. In SA 2/3 the mean Z-value for the full recruited stock is the same as PINHORN (1974) got from the calculation of the catch curve, thouth the age of full recruitment was 12 instead of 15 in our calculations. Perhaps the difference is produced by former age reading technic or by the fact that the calculations are based on age compositons from different areas (Subarea 2 and 3, respectively) and periods. But nevertheless it can be seen that the Z-values are the same for both areas and periods.

The mean fishing mortalities of the full recruited stocks of the last years are higher than $F_{0.1}$ only for SA 2/3 and M = 0.1. It can be stated that the mean fishing mortalities of last years were on an optimum level for the exploitation of the stocks. The resulting sustainable yield at $F_{0.1}$ are 31800 tons (M = 0.1) and 40600 tons (M = 0.2) for SA 2/3, and 7400 tons (M = 0.1) and 9800 tons (M = 0.2) for SA 0/1. This means that the mean catches of 34048 tons (1970 - 1974) from SA 2/3 and of 8025 (1970 - 74) from SA 0/1 were in the range of the possible sustainable yields at $F_{0.1}$. The MSY are 12 - 22 % higher than the sustainable yields at $F_{0.1}$. For the Y/R curves are flat-topped and the spawning stock-recruitment relation is not known it would be better to take into consideration the sustainable yields at $F_{0.1}$. The MSY calculated by PINHORN (1974) for SA 2/3 using M = 0.1 is only about 50% of the amount we got by our calculation using an other method and input data.

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Table 1: Cohort analysis using roundnose grenadier length composition data for 1969 - 1971, 1973 and 1974, ICNAF Subareas 2 and 3

L_∞ = 87 K = 0.0908

		M = 0.1			M = 0.2		
L	C_L (millions)	N_L (millions)	F/Z	F	N_L (millions)	F/Z	F
12	0.02	267.96	0.001	0.0001	1543.05	0.0001	0.00002
18	0.11	244.49	0.005	0.0005	1284.09	0.0005	0.0001
24	0.33	220.98	0.014	0.001	1051.17	0.0016	0.0003
30	0.68	197.63	0.029	0.003	843.10	0.004	0.0008
36	1.31	174.23	0.055	0.006	659.55	0.015	0.003
42	2.75	150.59	0.112	0.013	572.26	0.018	0.004
48	6.17	126.11	0.230	0.030	415.41	0.046	0.010
54	10.68	99.32	0.365	0.057	282.48	0.098	0.022
60	13.33	70.08	0.467	0.088	173.12	0.159	0.038
66	11.04	41.55	0.501	0.100	89.49	0.203	0.051
72	6.09	19.52	0.469	0.088	35.08	0.224	0.058
78	2.29	6.53	0.392	0.064	7.93	0.333	0.100
84	0.35	0.70	0.500	0.100			
Total	55.15	1619.71			6956.73		
weigted mean				0.016			0.004

Table 2: Cohort analysis using roundnose grenadier age composition data for 1973 and 1974, ICNAF Subareas 2 and 3

	M = 0.1				M = 0.2		
Age	C	N	F/Z	F	N	F/Z	F
3	0.083	189.498	0.0046	0.0005	741.797	0.00062	0.0001
4	0.165	171.381	0.010	0.0010	607.258	0.0015	0.0003
5	0.221	154.911	0.015	0.0015	497.033	0.0024	0.0005
6	0.303	139.955	0.022	0.0022	406.737	0.0041	0.0008
7	0.606	126.345	0.048	0.0050	332.735	0.010	0.002
8	0.662	113.741	0.058	0.0061	271.873	0.013	0.003
9	1.351	102.285	0.123	0.0140	221.992	0.033	0.007
10	3.115	91.264	0.267	0.036	180.530	0.088	0.019
11	4.548	79.614	0.382	0.062	144.987	0.150	0.035
12	5.293	67.710	0.461	0.086	114.590	0.207	0.052
13	6.257	56.230	0.554	0.124	89.029	0.287	0.081
14	6.257	44.926	0.612	0.158	67.229	0.351	0.108
15	7.498	34.698	0.719	0.256	49.381	0.476	0.182
16	6.230	24.263	0.756	0.310	33.645	0.531	0.226
17	6.312	16.027	0.838	0.517	21.909	0.652	0.374
18	3.005	8.497	0.819	0.452	12.226	0.609	0.312
19	0.799	4.830	0.655	0.190	7.291	0.391	0.228
20	1.461	3.610	0.843	0.537	5.246	0.643	0.360
21	0.221	1.877	0.568	0.131	2.973	0.299	0.085
22	0.744	1.488	0.5	0.1	2.234	0.333	0.100
Total	55.131	1433.150			3810.695		
			F_3+ = 0.044				F_3+ = 0.017
			$F_{15}+$ = 0.334				$F_{15}+$ = 0.242

Table 3: Cohort analysis using roundnose grenadier length composition data for 1969, 1970, 1973 and 1974, ICNAF Subareas 1 and 0

L_∞ = 80 K = 0.119

			M = 0.1		M = 0.2		
L	C_L (millions	N_L (millions)	F/Z	F	N_L (millions)	F/Z	F
18	0.05	39.31	0.015	0.002	136.94	0.002	0.0004
24	0.17	36.04	0.050	0.005	115.38	0.008	0.002
30	0.31	32.61	0.086	0.009	95.32	0.017	0.003
36	0.83	28.99	0.200	0.025	76.61	0.048	0.010
42	1.82	24.65	0.362	0.057	59.15	0.111	0.025
48	2.42	19.82	0.449	0.081	42.74	0.166	0.040
54	3.00	14.43	0.548	0.121	28.12	0.241	0.064
60	2.60	8.96	0.570	0.133	15.69	0.289	0.081
66	1.30	4.40	0.485	0.094	6.69	0.266	0.072
72	0.46	1.72	0.319	0.047	1.80	0.333	0.100
78	0.14	0.28	0.500	0.100			
Total	13.10	211.41			578.44		
weigted mean				0.034			0.014

Table 4: Cohort analysis using roundnose grenadier age composition data for 1973 and 1974, ICNAF Subareas 1 and 0

		M = 0.1			M = 0.2		
Age	C (millions)	N (millions)	F/Z	F	N (millions)	F/Z	F
3	0.026	45.417	0.006	0.001	178.481	0.0008	0.0002
4	0.052	41.069	0.013	0.001	146.105	0.0020	0.0004
5	0.065	37.110	0.024	0.002	119.574	0.0039	0.0008
6	0.098	33.497	0.030	0.003	97.822	0.0055	0.0011
7	0.125	30.215	0.039	0.004	80.001	0.0086	0.0017
8	0.249	27.045	0.089	0.010	65.386	0.021	0.0042
9	0.492	24.234	0.177	0.022	53.308	0.049	0.0103
10	0.708	21.459	0.261	0.035	43.200	0.084	0.018
11	0.866	18.743	0.332	0.050	34.729	0.122	0.028
12	0.938	16.136	0.386	0.063	27.650	0.160	0.038
13	1.272	13.708	0.506	0.102	21.789	0.249	0.066
14	2.144	11.193	0.690	0.223	16.688	0.431	0.141
15	2.046	8.088	0.753	0.304	11.723	0.515	0.212
16	1.488	5.372	0.772	0.339	7.747	0.541	0.236
17	0.669	3.445	0.694	0.227	4.996	0.443	0.159
18	0.754	2.481	0.791	0.378	3.485	0.574	0.269
19	0.426	1.528	0.773	0.341	2.171	0.547	0.242
20	0.393	0.977	0.842	0.533	1.392	0.646	0.365
21	0.098	0.510	0.690	0.223	0.784	0.424	0.147
22	0.184	0.368	0.500	0.100	0.553	0.333	0.100
Total	13.113	342.595			917.584		
				F_{3+}=0.044			F_{3+} = 0.016
				F_{15+}=0.316			F_{15+} = 0.221

Table 5: Roundnose grenadier length compositions data used for cohort analysis (per thousand)

	SA 2					SA 0/1			
length-group	1969	1970	1971	1973	1974	1969	1970	1973	1974
15 –	–	1	–	–	1	–	–	–	1
18 –	–	1	–	–	3	–	–	–	2
21 –	–	2	–	–	4	1	1	–	5
24 –	–	6	–	–	6	–	3	–	10
27 –	–	10	1	–	7	2	8	–	10
30 –	–	16	2	–	5	7	15	1	11
33 –	–	26	4	–	5	8	15	3	17
36 –	2	31	6	–	7	10	16	12	29
39 –	2	35	12	2	9	21	22	23	62
42 –	10	38	17	7	17	35	33	29	91
45 –	26	43	26	9	41	64	59	47	98
48 –	47	61	35	17	64	82	96	62	92
51 –	62	77	57	32	99	125	123	82	85
54 –	75	93	82	49	124	142	151	123	92
57 –	93	106	104	75	124	122	137	150	86
60 –	101	113	127	131	124	88	108	164	103
63 –	124	87	128	149	114	89	79	123	76
66 –	101	77	115	156	88	70	54	86	50
69 –	142	60	103	134	72	41	39	48	38
72 –	83	52	75	101	44	40	21	26	21
75 –	62	29	47	75	24	26	11	13	10
78 –	49	21	31	38	13	19	6	5	7
81 –	21	9	18	18	5	4	2	2	3
84 –	–	3	7	7	–	3	1	1	1
87 –	–	2	2	–	–	1	–	–	–
90 –	–	1	1	–	–	–	–	–	–
No. of fish measured	387	4981	6244	2032	2589	1200	9426	7759	9654

Table 6: Roundnose grenadier age compositions used for cohort analysis (per thousand)

A

Age	SA 2 1973	SA 2 1974	SA 0/1 1973	SA 0/1 1974
3		3		4
4		6		8
5		8		13
6		11		15
7	9	13		19
8		24	8	30
9		49	17	58
10	9	104	32	76
11	34	131	57	75
12	66	126	76	67
13	101	126	115	79
14	104	123	242	85
15	184	88	216	96
16	166	60	124	103
17	187	42	20	82
18	77	32	38	77
19	17	12	18	47
20	46	7	32	28
21		8	3	12
22+		27	2	26
No. of fish measured	2032	7291	7754	9654
ages read	84	439	156	2083

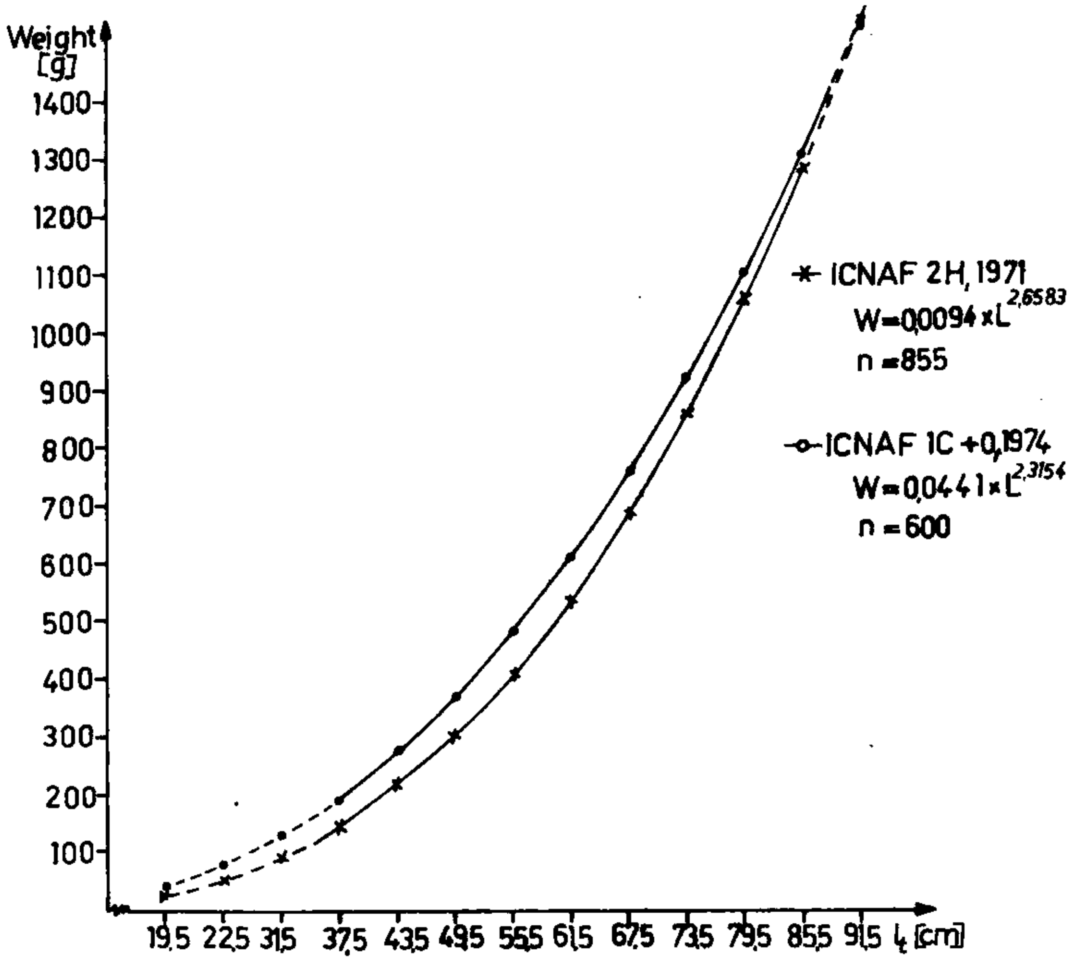


Fig. 1 Length weigth Relation for Roundnose Grenadier

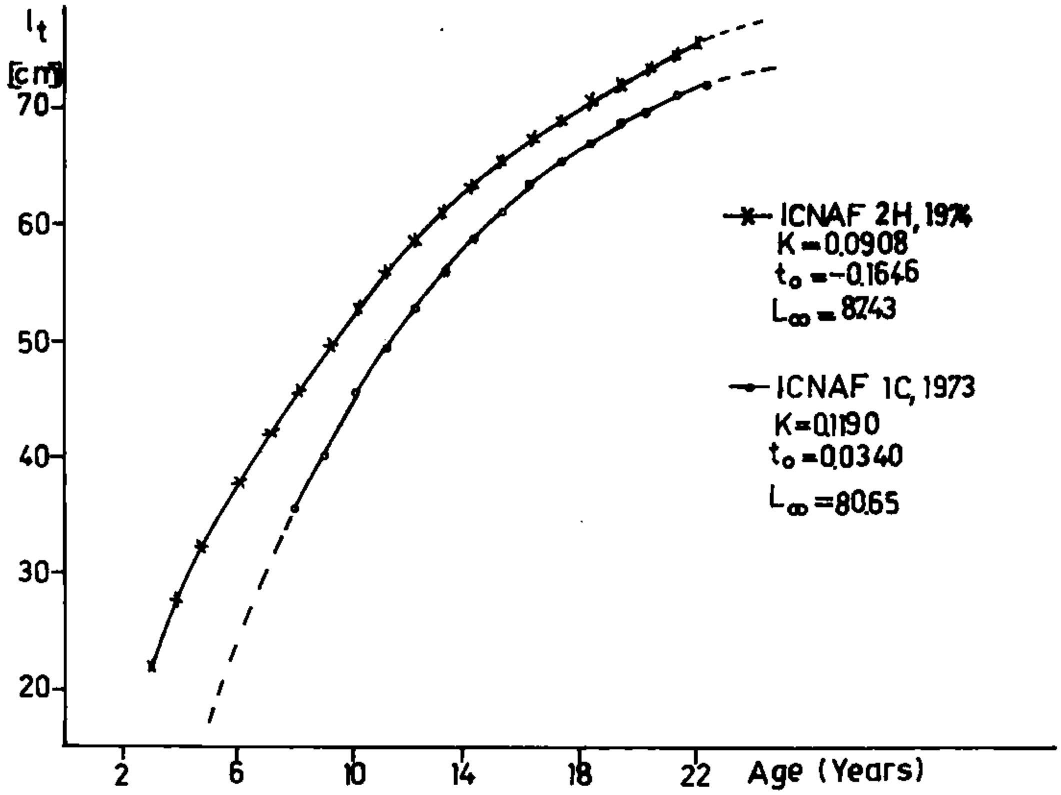
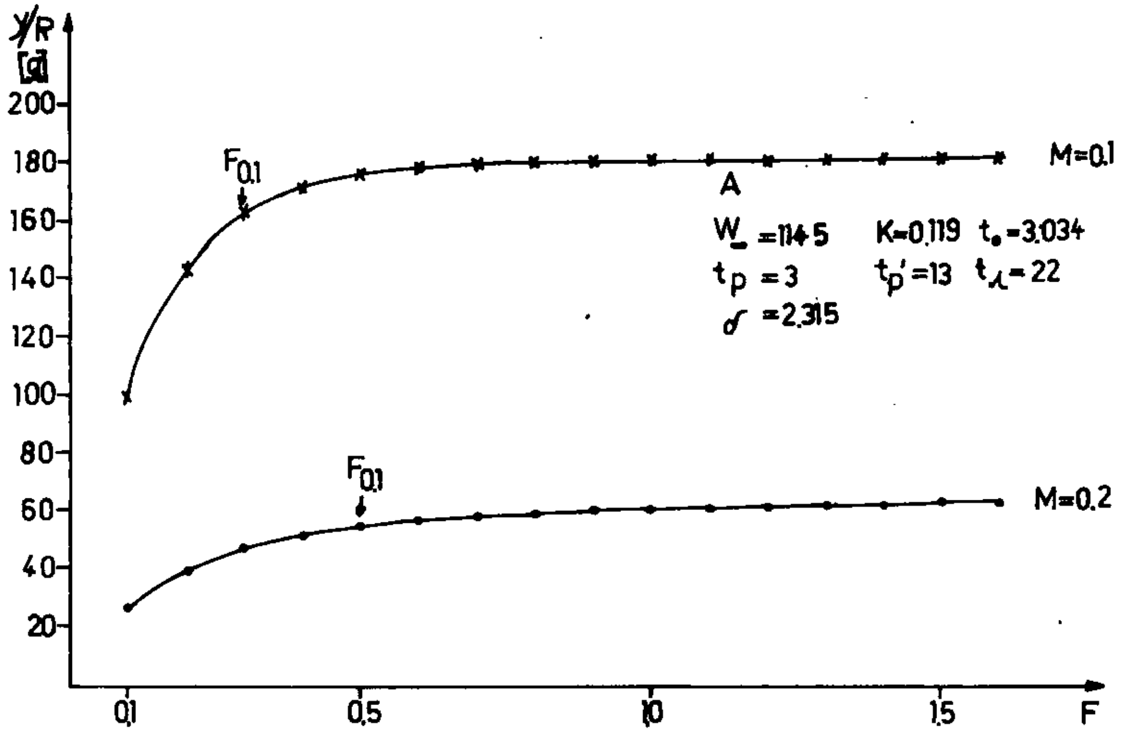


Fig. 2 Theoreticial Length-Age Curve for Roundnose Grenadier, based upon v. BERTALANFFY-Function



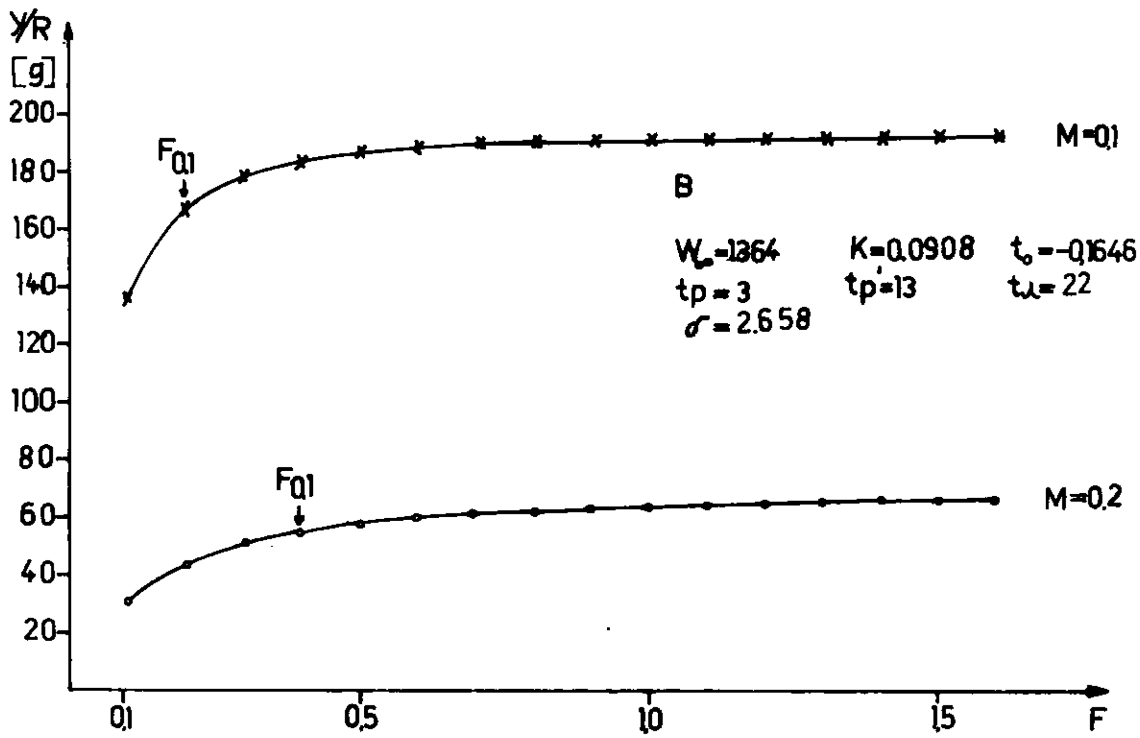


Fig. 3 Yield/Recruit for Roundnose Grenadier Stocks
A–ICNAF Subarea 1+0
B–ICNAF Subarea 2+3