

ASSESSMENT OF THE ATLANTIC HORSE MACKEREL STOCK
IN THE EASTERN-CENTRAL ATLANTIC AREA
(DIVISIONS 34.1.3.AND 34.3.1)
USING PROVISIONAL 1980 DATA

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ABSTRACT:

The VPA method has been used in assessing the Atlantic horse mackerel stock. The results indicated a normal exploitation pattern, with predominance in the last years of fishes older than 2 years old. The size of the recruited stock, both in terms of numbers and weight increased in the last five years. The biomass had a same continuously increasing tendency from 1976 till to 1980. From our assessment the horse mackerel stock size in 1981 will be to about 3.3 mil.tons.

INTRODUCTION

Three species of horse mackerel occur in Northwest African waters in exploitable quantities, Trachurus trachurus L., Trachurus trecae (CADENAT), and Trachurus picturatus (BOWDICH). Although the areal distribution of the three species overlapping in East-Central Atlantic area, the fishery off Mauritania is directed mainly on Atlantic horse mackerel (T.trachurus trachurus), which prevailing in the catches in proportion varying, according to hydrological conditions found in zone, between 77-100 per cent. T.trecae began to appear substantial in the commercial catches from 1972 till to 1976, after that year its

share being of much less importance. T.picturatus has a much more less participation in industrial fishery. Therefore, one can say that the Atlantic horse mackerel represents the biggest portion of the horse mackerel catches off Eastern-Central Atlantic area, and owing to lack of a true statistics in this paper we have considered the Trachurus spp. catches as T.trachurus trachurus.

The Atlantic horse mackerel population from the North-west African zone can be considered as a stock in the sense that larve produced by the spawning stock are recruiting as young fish to the same stock.

The distribution of the population according to size is not uniform, young horse mackerel being more concentrated usually near the shore in shallow waters.

MATERIAL AND METHODS

FISHERY TRENDS

Exploitation of the Atlantic horse mackerel population at Northwest Africa has a long history, the catches being until 1967 under 100 ths.tons. Subsequently, catches increased continuously from 161 ths.tons in 1968 to 481 ths.tons in 1971, decreased to about 451 ths.tons in 1972, and increased again to a maximum catch of 493 ths. tons in 1973. Up to 1977 the catches maintained to a mean level of about 460 ths.tons that in 1978 the whole catch to be only 330 ths.tons (Table 1, Fig.1).

Table 1.
Total and Romanian horse mackerel (Trachurus spp.) catches during 1965-1980 in the Eastern-Central Atlantic area (Ths.tons)

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Year	Catches		Year	Catches	
	Total	Romania		Total	Romania
1965	51.7	2.0	1973	486.4	29.1
1966	37.1	3.8	1974	493.2	34.5
1967	92.8	4.8	1975	453.2	26.4
1968	160.8	2.7	1976	430.4	13.5
1969	250.7	4.6	1977	492.3	38.6
1970	283.1	2.3	1978	330.4	33.7
1971	481.0	4.7	1979	330.0*	41.5
1972	450.8	13.8	1980	350.0*	61.9

* Estimated values

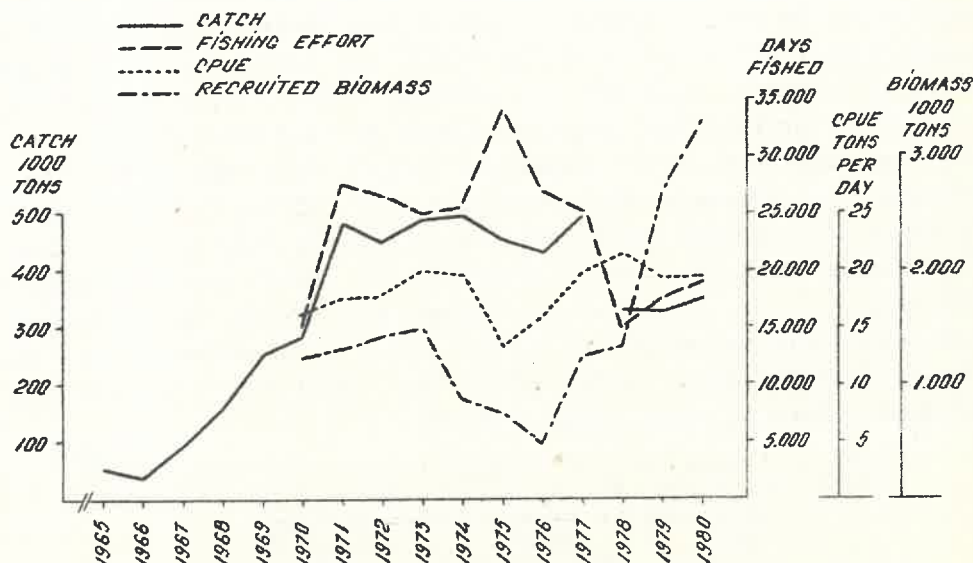


Fig. 1 - Atlantic horse mackerel: trends in catch, fishing effort and catch

Fishing effort followed the trend of the catches and catch per unit effort followed a slight downward trend over the period 1975-1978 with large fluctuations (Table 3, Fig.1).

The fishery was in part directed towards Atlantic horse mackerel concentrations and in part, a mixed fishery for chub mackerel, *T. trecae* and pilchard. Also, at least in the Romanian fishery, the by-catch of horse mackerel in the directed fishery for mackerel or pilchard was retained on board of the vessels. The by-catch of horse mackerel in the newly developed squid fishery is high enough to have a significant effect on horse mackerel abundance and the amount cannot be quantified at present. Since the real statistics are not available and the quantities discarded are unknown is very difficult to assess the horse mackerel population, the present assessment trying to evaluate the stock with data available now.

ASSESSMENTS

a/ BASIC MATERIAL

- Fishing effort. Data used in the calculation of total effort in the horse mackerel fishery were derived from the Romanian fishing effort (Table 2). The effort was calculated in fishing days of Romanian trawlers of tonnage class 7 (2100 GRT). This category was selected because vessels of this size participated in the directed horse mackerel fishery from the 1970 to the present. To estimate the catch per unit effort (CPUE) of this vessels category per month, only those entires were used in which the horse mackerel participation in the total catch exceeded 500 Kgs. On this basis, total international effort was estimated for each month and summed up to the annual total effort (Table 3). In the last two years, total effort was derived from a regression of days fished on total catch (Fig.2).

Table 2
Romanian fishing effort (fishing days) and CPUE (t/day)
during 1972 - 1980 in the Eastern-Central Atlantic area

Year	Effort (fishing days)	C.P.U.E. (t/day)
1972	813	16.974
1973	1467	19.843
1974	1798	19.210
1975	1980	15.373
1976	839	16.062
1977	1963	19.686
1978	1537	21.952
1979	1030	40.256
1980	1833	33.761

Table 3
Total and Romanian horse mackerel catches and effort
during 1972-1980 in the Eastern-Central Atlantic area

Year	S.R. of Romania		Total	
	Catch (tons)	Effort (days)	Catch (tons)	Effort (days)
1972	13,800	813	450,784	25,557
1973	29,110	1467	486,387	24,511
1974	34,540	1798	493,201	25,674
1975	26,412	1980	453,214	33,974
1976	13,476	839	430,423	26,798
1977	38,643	1963	492,300	25,008
1978	33,740	1537	330,400	15,404
1979	41,464	1030	330,000	17,769
1980	61,884	1833	350,000	19,064

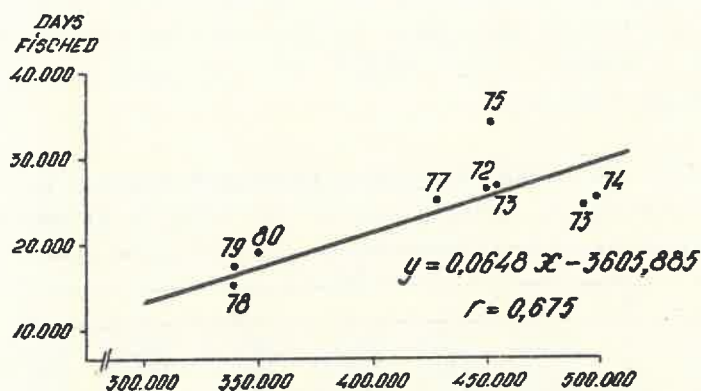


Fig. 2 - Atlantic horse mackerel: regression of fishing effort on catch

- Length composition. Data from Romanian catches measured on board of commercial vessels at sea were available covering the entire period from 1972 to 1980. The length composition of the total international catch in numbers per cm-group was calculated, considering the distribution of the catch by season.

- Age composition. The age-length keys for the entire period was available and these were used for each year. This procedure implies that are changes in growth during the whole period under consideration. The total catch in numbers per cm-group was then converted to numbers per age-group (Table 4).

Table 4

Horse mackerel (*Trachurus trachurus trachurus*)
in Eastern-Central Atlantic area:
Catch in numbers (x10³) by age-group, 1972-1980

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Year	Age								Total
	0	1	2	3	4	5	6	7+	
1972	-	1723.9	922.2	466.7	231.9	122.9	60.1	25.9	3553.6
1973	-	3119.9	864.6	318.6	145.4	76.5	54.9	71.4	4651.3
1974	1168.4	4038.6	1126.8	285.9	53.4	19.2	19.5	23.4	6735.2
1975	1445.7	3143.5	740.0	228.3	73.4	11.5	4.8	2.5	5649.7
1976	3443.3	2506.5	748.7	106.4	38.9	17.9	4.8	0.3	7866.8
1977	45.2	3670.7	1754.7	476.9	61.2	15.0	7.9	2.4	6034.0
1978	67.3	1853.8	1306.0	380.4	79.5	18.5	3.9	4.7	3714.1
1979	-	1951.3	816.1	335.6	238.6	52.8	14.9	2.7	3412.0
1980	-	-	845.5	421.3	557.9	213.4	49.7	10.3	2098.1
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- Mean weight per age-group. For the period 1972-1980 the mean weights per age-group, were calculated by centralization of the age samples in each year. In this way can be explained the differences between mean weight of the same age-group in different years (Table 5).

Table 5

Horse mackerel (Trachurus trachurus trachurus)
in the Eastern-Central Atlantic area: Mean weights by age-group(g)

Year	Age						
	0	1	2	3	4	5	6
1972	-	67.2	109.5	186.4	268.3	348.4	420.0
1973	-	70.0	118.7	166.4	207.4	343.2	407.7
1974	15.2	67.9	103.3	165.6	323.5	461.7	520.6
1975	23.2	81.6	123.1	186.6	290.3	395.3	503.8
1976	18.0	68.0	119.0	174.0	310.0	434.0	515.0
1977	21.7	57.4	98.2	169.3	286.1	361.1	434.0
1978	19.6	66.3	85.0	162.4	278.3	374.4	488.5
1979	-	62.4	117.7	164.2	254.6	339.0	400.0
1980	-	-	95.7	156.7	227.6	316.9	417.5

b/ PARAMETERS USED

- Natural mortality (M). The value of $M=0,5$ used in the present assessment was taken from estimates based on data of catch and population size on fishing effort (3,4) and on estimates for T.trachurus trachurus found in the literature (2).

- Initial fishing mortality for the oldest age-group. Analysis based on average length composition data for two groups of years was carried out to estimate F for the cm-groups which represent the fishes of age 7 and older. The average F's for the largest fish were 0.306 and 0.382 and, consequently, an F of 0.344 was taken as the starting value.

- Exploitation pattern (partial recruitment). Mean fishing mortalities for each cm-group for the period 1974 - 1978 were obtained from the analysis on length data, and by using the age-length key average F's for each age-group were estimated, which was served as the basis for construction of an array of proportional F's to be applied to the average F in 1979 and 1980 (Table 6).

Table 6

Horse mackerel in Eastern-Central Atlantic area :
Parameters used for catch prediction

Age	1980 stock (no.x10 ³)	1980 catch (no.x10 ³)	1981 stock (no.x10 ³)	Mean F
2	12,068.0	845.5	13,563.3	0.198
3	3,512.9	421.3	8,255.7	0.306
4	4,249.1	557.9	2,357.0	0.332
5	1,358.5	213.4	2,734.6	0.394
6	337.4	59.7	870.5	0.401
7*	131.9	10.3	249.8	0.215

- Fishing mortality in 1980. The average F's for the years 1972 to 1979 were plotted against the fishing effort in the respective years and a linear regression was calculated. Was taken as a starting value for 1980 F = 0.415 (Fig. 3).

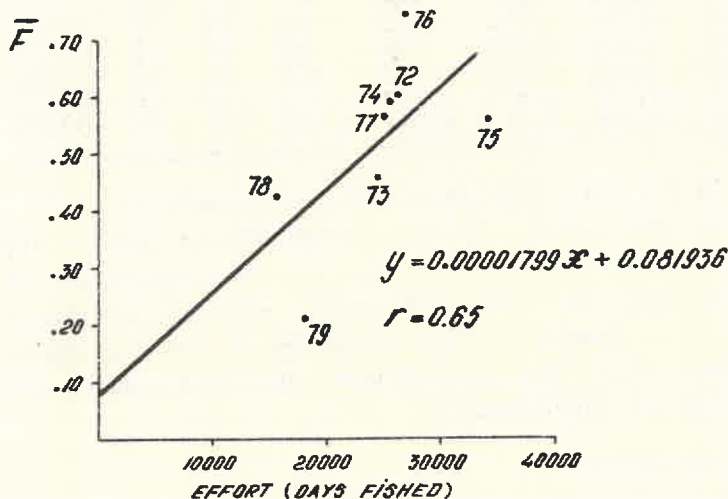


Fig. 3 - Atlantic horse mackerel: regression of $\bar{F}$ on fishing effort

RESULTS

a/ STOCK SIZE (Table 7, Fig.1)

The size of the recruited stock, both in terms of numbers and weight had a slight increase during the period 1970

to 1973, after that decreasing sharply from 1,471,000 tons in 1973 to 533,000 tons in 1976, representing only 36% of the previous level. This decline is due to the high level of exploitation and due to four recruiting year-classes well below the previous average. As a result of increasing trend in recruitment and of reducing of the exploitation, the size of the stock increased highly in the subsequent period, in 1980 being 2.3 times bigger than the 1972 level.

Table 7

Horse mackerel in Eastern-Central Atlantic area:
Stock in numbers ($\times 10^3$), 1972 - 1980

Year	Age						Total
	2	3	4	5	6	7+	
1972	4,006	2,027	1,007	534	261	112	7,947
1973	4,759	1,754	800	421	302	393	8,429
1974	4,927	1,250	233	84	87	102	6,683
1975	3,403	1,050	338	53	22	12	4,878
1976	2,773	394	144	66	18	1	3,396
1977	7,999	2,174	279	68	36	11	10,567
1978	7,681	2,237	768	209	43	28	10,966
1979	10,578	4,350	1,797	555	193	35	17,508
1980	12,068	3,513	4,249	1,359	337	132	21,658

In the last four years the participation in the catches of two years old fishes reduced continuously while increased fishes of four, five, six, seven and older. The proportion of horse mackerel age four and older generally shows an increasing trend since 1976 as a result of concentration of the fishery in areas where larger fish are predominant and as a result of the increasing trend in recruitment.

b/ FISHING MORTALITY

Following the trend in fishing effort, weighted average of fishing mortality increased from 1972-1973 level of about 0.5 to 0.75 by 1976 decreasing then to 0.56 in 1977. Due to reducing effort and diminishing the catches F continued to boil down to a value 0.213 in 1979.

CATCH PROJECTION FOR 1981 AND 1982 AND CONCLUDING REMARKS

The basic data and parameters used to calculate catches for 1981 and the resulting biomass for 1982 are given in Tables 5 and 6. The results for the 1981 horse mackerel fishery in the Eastern-Central Atlantic area in 1981 and stock biomass in 1982 are given in Fig.4.

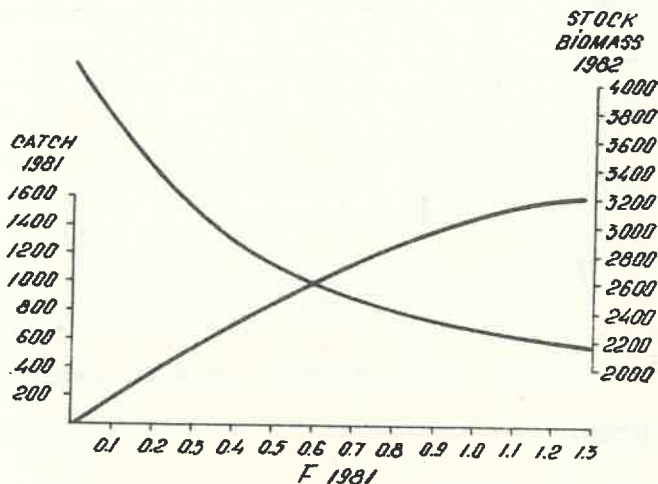


Fig. 4 - Atlantic horse mackerel: catch in 1981 and stock biomass in 1982 (lo³ tons) at different levels of F in 1981

Since the BEVERTON and HOLT yield ($\frac{1}{2}$) per recruit curve (Fig.5) calculated on the basis of the parameters given in Table 6 has no well defined maximum, the best F is to a level around $F = 0.34$ which would result in a catch of 580 ths.tons in 1981. The resulting recruited biomass would then remain stable at the 1980 level. Fishing with a resulting fishing mortality at which the slope of the yield per recruit curve is $1/10$ of the slope at the origin, $F_{0.1} = 0.27$ would allow a catch of 438 ths. tons in 1981. Under this option, the recruited biomass is expected to increase by the beginning of 1982 by about 6% compared to 1980.

In this paper we have made an attempt to work out an analytical assessment for the Atlantic horse mackerel stock in the Eastern-Central Atlantic area. There are several weaknesses,

especially in the fishing effort calculations and due to the limited data on which the assessment has to be based. Therefore, we cannot expect that the results have a high degree of precision as compared to assessment based on more sufficient data. However the results indicate the order of magnitude of stock biomasses and total allowable catches to be expected in the near future.

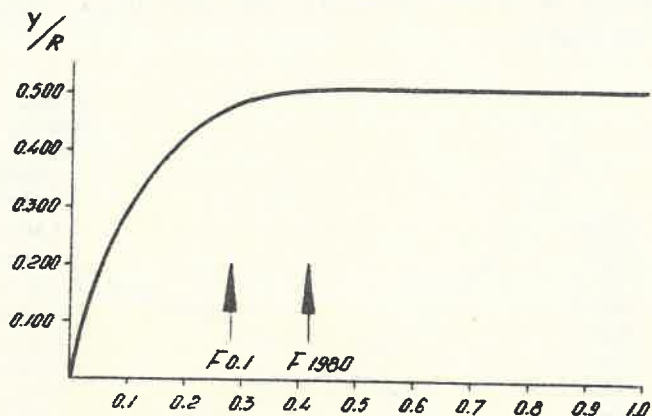


Fig. 5 - Atlantic horse mackerel: yield per recruit curve

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