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AGE AND GROWTH OF TRACHURUS TRACHURUS L.
FROM NORTH WEST AFRICAN WATERS

by

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INTRODUCTION

The aim of this paper is to define the rate of growth
of the horse mackerel, Trachurus trachurus from the North
West Africa waters and the characteristics of its popula-
tion exploited by Polish fisheries. This study was carried
out on the basis of materials collected during the period
from 1967 to 1974 in the Northern part of the area from
lat. 17° N to 26° N, from commercial and exploratory
catches. The length measurements included 19.599 fish whose
length oscillated between 10 and 42 cm. 1843 otoliths were
examined of which 104 were illegible.

Due to the fact that the spawning period extends from
October to May /Overko - 1969/, it has been admitted after
Kompowski and Wysokiński /1973/ the first of January as the
birth date. The grouping of fish from different catch periods

in age groups was done taking into consideration of this
assumption. The rate of growth of males and females was
not separately examined due to the insufficiency of materials.

Age and growth of horse mackerel /Tr. trachurus/

The length measurements have been presented in Tables
1a - g. As it appears from these tables, the length compo-
sitions are polymodal which facilitated the determination
of the frequency of particular age groups. Their mean length
is given in Table 2.

Table 2.

Mean length of the particular age groups /in cm/

Month and year of catches	Age group							
	0	I	II	III	IV	V	VI	VII
November 1967	14.9	17.7	20.7	24.0	28.0	30.0	-	-
December 1967	-	18.1	21.5	-	-	-	-	-
January 1968	-	18.1	21.8	25.0	28.2	30.6	-	-
August 1968	13.4	19.4	23.7	26.4	28.8	30.8	32.1	-
October 1968	14.4	19.1	23.8	28.0	30.9	-	-	-
November 1968	13.4	19.8	23.8	28.0	30.5	31.6	-	-
February 1969	-	-	-	-	-	30.5	31.6	32.7
February 1970	-	19.1	21.5	24.1	27.9	30.6	31.4	33.0
February 1972	-	-	22.5	25.5	28.0	30.0	32.0	33.8
March 1972	-	-	-	-	-	31.8	33.6	34.6

From the data presented in the above table it results
that the differences in the mean length of the particular
generations in the months of December - January - February
are insignificant, which shows a stability in the growth
of horse mackerel during this period.

Admitting the length of a seven year old fish as one
hundred percent, we get the following growth rate in the
consecutive years of its life:

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I year   - 56,6 %

II year - 11.6 %

III year - 10.0 %

IV year -   9.4 %

V year   -   8.1 %

VI year -   3.1 %

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These data show that the growth rate of the horse mackerel
varies in at different stages' of its life. The horse
mackerel grows the most rapidly during the first year when
all metabolism serves to increase the size of the fish.
During the second year, the horse mackerel attains its
sexual maturity /Overko, 1969/ and in connection with this
there is a significant slowing down of the growth. It should
be stated, however, on the basis of studies of older fish
otoliths and increment tendencies that horse mackerel grows
during all its life.

The mean weights of horse mackerel in particular years of
its life are given in Table 3.

Table 3.

Weight of Tr. trachurus in the consecutive age groups
/ in gr./

Age group	I	II	III	IV	V	VI	VII
weight	43.5	83.0	121.0	-	-	310.0	359.0

The relation between the total length and the weight may
be defined by the formula:

$$W_t = K \cdot L_t^n$$

where:

W_t = the fish weight at age t

L_t = total length of the fish at age t

k and n = constant coefficients.

Coefficients k and n have been estimated according to
empirical data by the method of the smallest squares and
have the following values:

k = 0.0049,   n = 3.14

hence: $W_t = 0.0049 \cdot L_t^{3.14}$

The parameters of growth equations

The parameters of linear growth were determined according
to the Bertalanffy formula:

$$L_t = L_\infty \left(1 - e^{-k/t-to/} \right)$$

L_∞ was determined by use of Ford-Walford method /Fig.2/.

The Parameters K and to have been estimated according
to the method of the smallest squares and have the
respective values:

$$\underline{K = 0,13 \qquad to = -2,32}$$

Applying the above values we get the following equation
of linear growth of Tr. trachurus:

$$L_t = 50 \text{ cm } 1 - e^{-0.13 /t + 2.32/}$$

The consecutive values L estimated according to this equa-
tion do not show significant differences with the mean
values obtained from the empirical observations /Table 4./.

Table 4.

Mean lengths of horse mackerel /Tr.trachurus/
in the particular age groups

Method	Age groups							
	O	I	II	III	IV	V	VI	VII
empirical observations	-	18.1	21.8	25.0	28.2	30.6	-	-
Bertalanffy equation	13.02	17.52	21.99	24.96	28.01	30.65	33.05	35.11

Applying the previously calculated length/weight equation
we have: $W_{oo} = 1 057$ g.
The weight growth in the age function is given according
to the formula:

$$W_t = 1 057 \text{ g } \left[1 - e^{-0.13 /t + 2.32/}\right] 3,14$$

The graphs of the growth function is shown in Fig. 1.

Length and age composition of the horse mackerel in Polish catches

. The length composition of horse mackerel in the years 1967 - 1974 has been shown in Fig. 3. As it results from the Fig. 3 in all the discussed years several modes can be observed which corresponds to length groups: 16 - 20 cm, 22 - 26 cm and 32 - 36 cm.

. The age composition of catches is shown in Fig. 4. During the years 1967-1972 there was constated a large presence of the V, VI and older age groups accompanied by a sensible frequency of the younger age groups /I to III/. In the years 1973 and 1974 the frequency of age group IV and older ones in the catches significantly decreased to the profit of younger age groups /I - III/. This leads to suppose that older generations had been overfished.

We should, however, emphasize that in the years 1973-1974 the Polish fishing fleet operated only in the area of lat. 21-26° N, /Spanish Sahara Shelf exclusively/, where usually there is observed a considerable presence of young fish of a smaller size. In general it should be noted that it is impossible to draw accurate conclusions from the actual studies limited to the fraction of Tr.trachurus population.

BIBLIOGRAPHY

Overko S.M.: K biołogii rozmnożenia stawrid rodow
             Trachurus i Decapterus u siewiero-zapadnogo
             pobierieżia Afriki. AtlantNIRO. Trudy wyp.
             XXII. Kaliningrad, 1969.

Kompowski A., Wysokiński A.,: Creation of growth zones on
             otoliths of the common horse mackerel /Trachu-
             rus trachurus/from the area of Cap Blanc /
             under print.

Wiktor J.;   A simplified method of estimating the compo-
             sition of the fish populations from the length
             curve. Papers from scientific symposium on
             the XXth anniversary of the Branch of Sea
             Fisheries Institute at Świnoujście.

Length and age composition of _Trachurus trachurus_
catches - November 1967

Length /cm/	Age groups							Total
	0	I	II	III	IV	V	VI	
11	8							8
2	18							18
3	23							23
4	26							26
5	66							66
6	91	31						122
7	18	112						130
8		129	14					143
9		74	25					99
20			38					38
1			57					57
2			31	10				41
3			16	17				33
4			16	16				32
5				15				15
6				5	6			11
7				5	10			15
8					34	14		18
9					20	16		36
30						32	25	57
1						44	22	66
2							185	185
3							181	181
4							116	116
5							61	61
6							25	25
7							5	5
8							2	2
Total	250	346	181	68	70	106	622	1.643
%	15,2	21,1	11,0	4,0	4,3	6,4	37,9	100,0
Mean length	14,9	17,7	20,7	24,0	28,0	30,0	-	-

Length and age composition of Tr.trachurus catches

January, 1968

Length cm	Age groups						Total
	I	II	III	IV	V	VI	
12	1						1
3	2						2
4	5						5
5	5						5
6	15						15
7	28	18					46
8	66	39					105
9	63	47					110
20	19	25					44
1		26					26
2		42	9				51
3		63	37				100
4		73	84	12			169
5		39	152	39			230
6		13	158	26			197
7			10	82			92
8				84			84
9				106	19		125
30				55	111		166
1				55	111		166
2					197		197
3					230		230
4					189		189
5						110	110
6						69	69
7						18	18
8						5	5
Total	204	385	450	459	857	202	2.577
%	7,7	15,0	17,6	18,0	33,6	8,2	100,0
Mean length	18,1	21,8	25,0	28,2	30,6	-	-

Length and age composition of <u>Tr.trachurus</u> catches

August 1968

Length cm	Age groups								Total
	0	I	II	III	IV	V	VI	VII	
10	1								1
1	1								1
2	4								4
3	9								9
4	10								10
5	6								6
6	3	3							6
7		9							9
8		10							10
9		3							3
20		9							9
1		18	3						21
2			109						109
3			282						282
4			298	12					310
5			190	8					198
6				43	3				46
7				14	30				44
8				30	14				44
9					65	21			86
30					45	30			75
1						81	6		87
2						31	12	6	49
3							10	17	27
4								13	13
5								15	15
6									-
7								1	1
8								1	1
Total	34	52	882	107	157	163	28	53	1.476
%	2,1	3,3	59,8	7,3	10,7	11,1	2,0	3,7	100,0
Mean length	13,4	19,4	23,7	26,4	28,8	30,8	32,1	-	-

Length and age composition of <u>Tr. trachurus</u> catches

November 1968

Length cm	Age groups							Total
	0	I	II	III	IV	V	VI+	
11	2							2
2								-
3	10	2						12
4	10	9						19
5	2	15						17
6		5						5
7		4						4
8		12						12
9		14						14
20		22						22
1		27						27
2		52	53					105
3		16	181					197
4			200					200
5			84	7				91
6			38	8				46
7				26				26
8				31				31
9				19	12			31
30				19	17	3		39
1				3	21	18		42
2					11	27		38
3						4	17	21
4							14	14
5							2	2
6							1	1
Total	24	178	556	113	61	52	34	1.018
%	2,4	17,5	54,6	11,1	6,0	5,1	3,3	100,0
Mean length	13,4	19,8	23,8	28,9	30,5	31,6	-	-

Length and age composition of <u>Tr. trachurus</u> catches

February 1970

Length cm	Age groups								Total
	I	II	III	IV	V	VI	VII	VIII+	
16	2								2
7	8								8
8	10								10
9	14	9							23
20	16	19							35
1	7	35							42
2	3	44	6						53
3		17	3						20
4		6	6						12
5			3	3					6
6			3	2					5
7			3	3					6
8				7	4				11
9				12	12				24
30					29	28			57
31					27	41	14		82
32					29	43	43	14	129
33						33	89	-	122
34							56	18	74
35								41	41
36								15	15
37								3	3
Total	60	130	24	27	101	145	202	91	780
%	7,7	16,7	3,1	3,5	12,9	18,6	25,9	11,6	100,0
Mean length	19,1	21,5	24,1	27,9	30,6	31,4	33,0	-	-

Length and age composition of Tr.trachurus catches

February 1972

Length cm	Age groups						Total
	II	III	IV	V	VI	VII	
20	4						4
1	6						6
2	9	9					18
3	50						50
4		73					73
5		89					89
6		111					111
7		84	46				130
8			138				138
9			32	51			83
30				44			44
1				10	10		20
2				12	28	4	44
3					13	107	120
4						118	118
5						53	53
6						6	6
Total	69	366	216	117	51	288	1.107
%	6,2	33,1	19,5	10,6	4,6	26,0	100,0
Mean length	22,5	25,5	28,0	30,0	32,0	33,8	-

Length and age composition of Tr. trachurus catches

February 1969

Length cm	Age groups					Total
	V	VI	VII	VIII	IX+	
29	2					2
30	16	10				26
1	14	18	6			38
2	3	28	22			53
3		4	26	7		37
4			13	13	5	31
5				10	4	14
6						–
7						–
38					1	1
Total	35	60	67	30	10	202
%	17,3	29,7	33,2	14,8	5,0	100,0
Mean length	30,5	31,6	32,7	34,1	–	–

March 1972

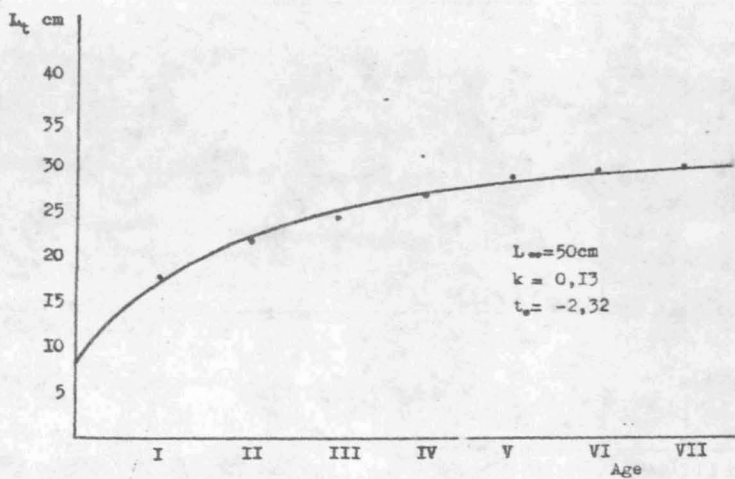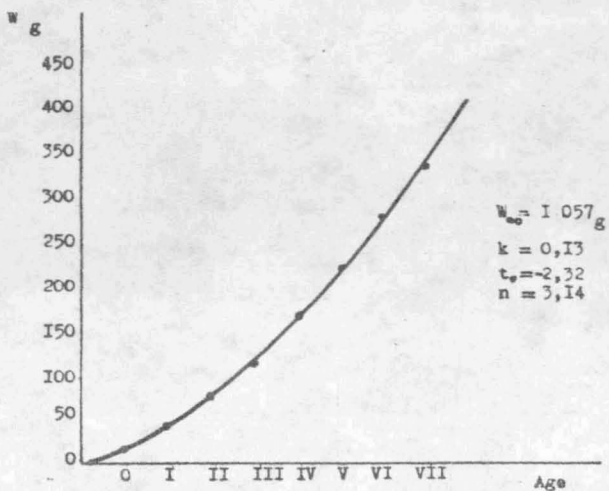| Length cm	Age groups					Total
	V	VI	VII	VIII	IX+	
29	1					1
30	3					3
1	1					1
2	3	8				11
3	7	47	21			75
4		64	99	38		201
5		9	104	69	9	191
6			19	25	17	61
7			7	7	8	22
8					11	11
9					2	2
40						
1						
2					1	1
Total	15	128	250	139	48	580
%	2,6	22,1	43,0	24,0	8,3	100,0
Mean length	31,8	33,6	34,6	35,0	–	–

Fig. 1. Curves of growth by length and wieght of
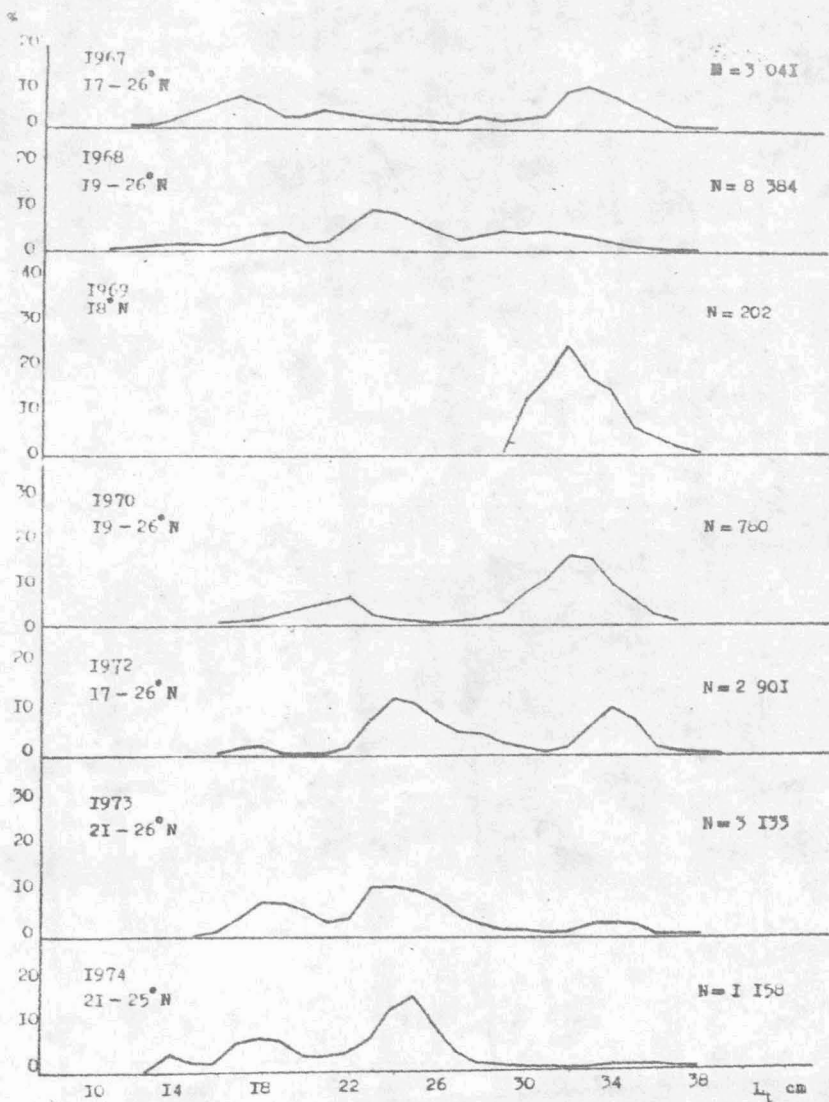Trachurus trachurus caught in NW Africa
fishing grounds.

Fig. 3. Length composition of Tr. trachurus catches in NW Africa waters /1967 - 1974/
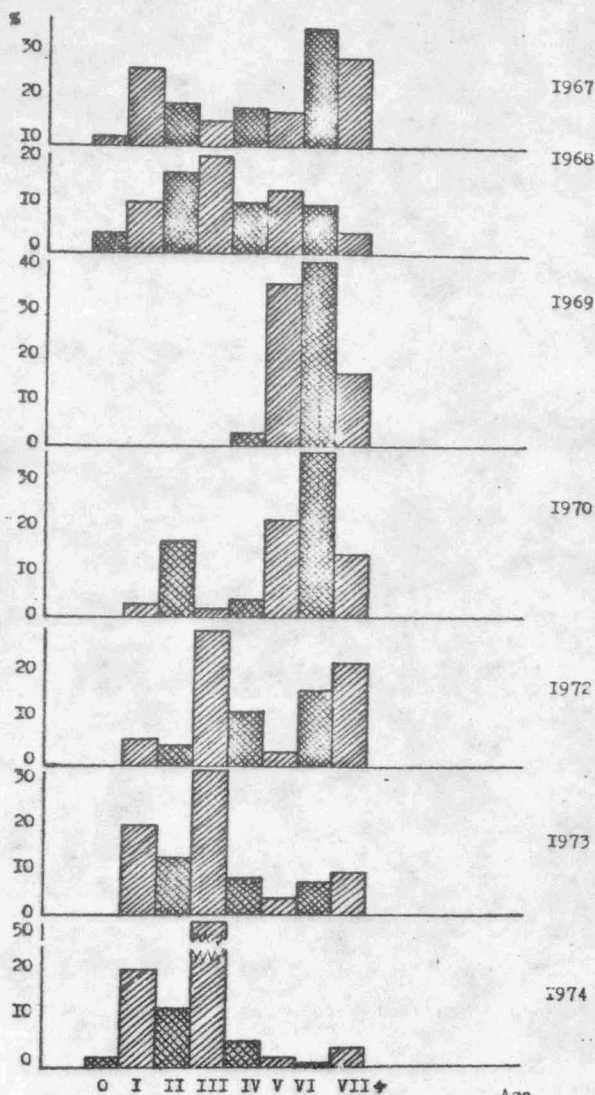
Fig.4. Age composition of Tr.trachurus catches in NW Africa
waters /1967 - 1974/